MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 38 FEBRUARY, 1932 Number 6

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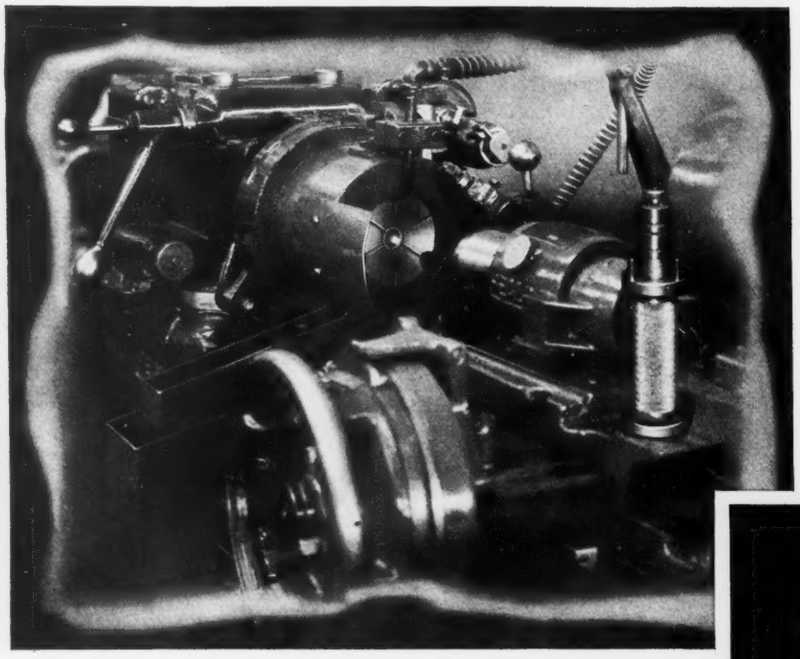
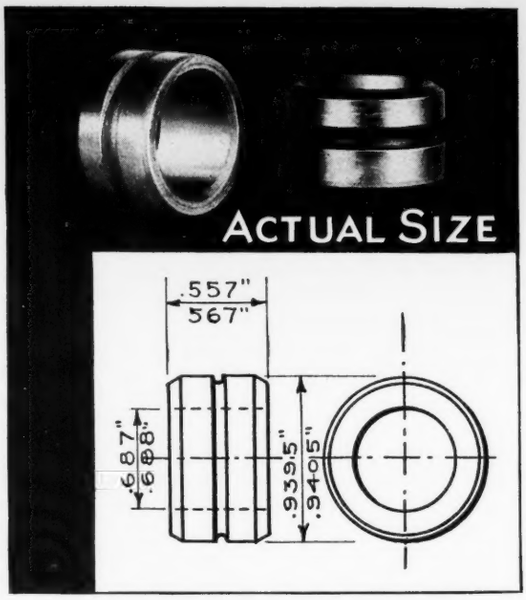
615 Per Hour . . .
One Operator-Two Machines



AT a well-known automobile plant, we recently installed a pair of Gage-Matic machines for internally grinding small hardened steel bushings to tolerances of .0005" for taper and .0002" maximum out-of-roundness, removing .008" to .010" of stock. Before the internal grinding operation, they are centerless ground on the O. D.

The parts are held in a double diaphragm fixture, two parts were loaded with a plug, at a time. We estimated a production of 250 pieces per hour from each machine, on the basis of one operator running two machines.



On a production run before the customer's factory officials, the operator running both machines ground 1,230 bushings in 2 hours, an average of 615 per hour, with only one piece scrapped. Time for necessary changes of wheels and adjustments of diamonds were included.

These results were obtainable due primarily to the entirely automatic grinding cycle of the Heald Gage-Matic. All the operator has to do is to load the work and the machine does the rest automatically. An automatic ejector in the fixture eliminates unloading and discharges the work into a chute at the conclusion of grinding.

This is not an isolated installation where one operator, with a pair of Heald Automatics, has given an amazing increase in production, cutting the cost very materially. Other products such as gears, ball bearings, etc., are being handled in a similar manner.

The Heald Machine Company, Worcester, Massachusetts, U. S. A.

Branch Offices at Chicago, Cleveland, Detroit, New York and Philadelphia

HEALD

MACHINERY

Volume 38 NEW YORK, FEBRUARY, 1932 Number 6

Automatic Arc Welding in a Modern Tank Shop

By R. B. LINCOLN
Manufacturing Engineer
Westinghouse Electric & Mfg. Co.

WELDING has frequently been thought of, in the past, as an auxiliary process carried on in a corner of the shop; and it is still used advantageously in this way where occasional welding jobs are to be done. But the day of large, completely equipped shops used exclusively for arc welding has arrived. At East Pittsburgh, the Westinghouse Electric & Mfg. Co. has erected a plant 400 feet long by 75 feet wide for the welding of tanks for electric circuit-breakers. Even the building that houses this plant is arc-welded—a fitting type of construction for a welding shop.

In this plant every effort has been made to provide the latest methods, and automatic arc-welding machines are used wherever they are applicable.

Three aisles run the length of the building to permit, as nearly as possible, a straight-line flow of the work. The equipment in the aisle seen at the left in the heading illustration is used for the manufacture of the smaller details. When these details have progressed to a certain point, they are transferred to the main aisles, where they become parts of larger assemblies. Tanks from 48 inches to 10 feet in diameter and up to 16 feet in length are produced in the middle aisle, and smaller tanks in the aisle near the right-hand wall.

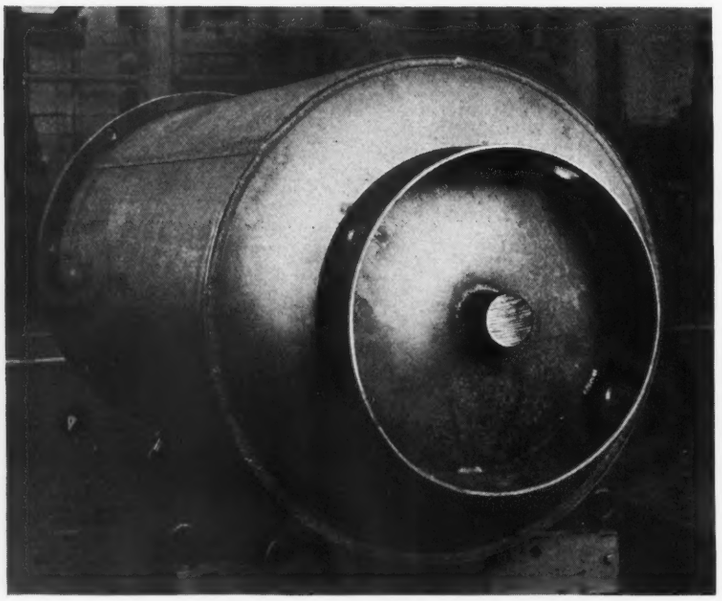


Fig. 1. Ten-foot Tanks are Welded to Withstand Pressures of Hot Oil up to 300 Pounds per Square Inch

All materials enter at the far end of the building, after being sheared to size in the storage yard or at the steel mill. The tank heads are formed in one operation under a 1500-ton hydraulic press. Three electric furnaces are installed adjacent to this press for heating the steel plates, and suitable handling equipment is provided.

Steel sheets intended for the side walls of the tanks go to a plate planer nearby, where the edges are machined to the correct developed tank length. The edges are beveled to an angle of 20 degrees so as to obtain a 40-degree vee at the joint. In the welding operation, the joint edges are spaced about 5/32 inch apart. It has been found that if the edges are beveled to an angle of 30 or 45 degrees, as for hand welding, the thin edges have a tendency to burn away.

From the plate planer, the steel sheets go to a bending roll designed on the pinching principle. This machine bends the sheets to the desired curve, practically to the edges, and thus avoids the formation of a flat portion near the edges. The machine has four rolls. The cylinders formed in this machine are tack-welded by hand along the longitudinal seam, and are then rolled along the floor to an automatic seam-welder.

Required Properties of Welds on Circuit-Breakers

The welded seam of the circuit-breakers must be equal in strength to the plate itself and capable of holding hot circuit-breaker oil at pressures up to 300 pounds per square inch. Even minute leaks that would result in a negligible loss of oil are not permissible, because an oily spot on the outside of the circuit-breaker would collect dust and present an unsightly appearance.

When heated, the circuit-breaker oil is of such a penetrating nature that it is impracticable to make riveted joints that will retain it, especially after the tanks are subjected to the shock incident to breaking a short circuit current. When this happens, an electric arc forms in the oil with explosive violence and the tank is momentarily subjected to a high pressure.

Riveted joints calked by welding, both along the edge of the sheet and around all rivet heads, are satisfactory for strength and tightness, but require practically as much welding as joints having no rivets, because the weld takes most of the load. The load is divided between the rivets and the weld in proportion to the rigidity of each, and the weld is more rigid than the rivets. For this reason, the Westinghouse Electric & Mfg. Co. decided to use the welding process exclusively in joining the seams of tanks for circuit-breakers. By following this procedure, substantial savings in cost have been realized, and the appearance of the product has been improved.

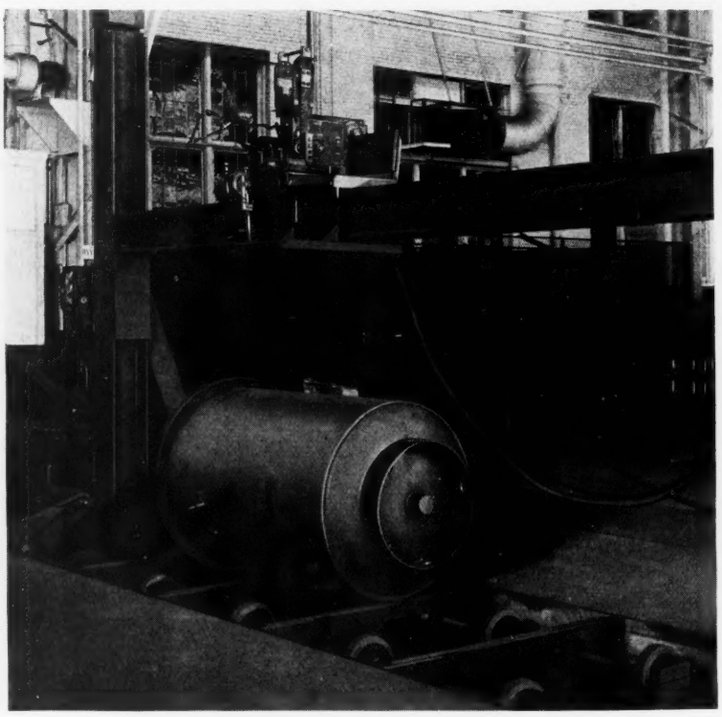


Fig. 2. Universal Machine that Welds Both Longitudinal and Circumferential Seams without the Tank being Removed

Tests have shown that the flange required at the circumference of the head when rivets are used can be eliminated when the joint is made by welding exclusively. The head, dished to the correct curve to resist the pressure, is welded to the side wall, as shown in Fig. 1, by means of an automatic machine. This joint is subjected to bending, as well as tension and shear, and more welding is required than when a flanged head is used and the weld located so as to be free from bending stresses. In a general way, the flanged heads have been found advantageous for the larger sizes of circuit-breakers, and the style illustrated for the smaller sizes.

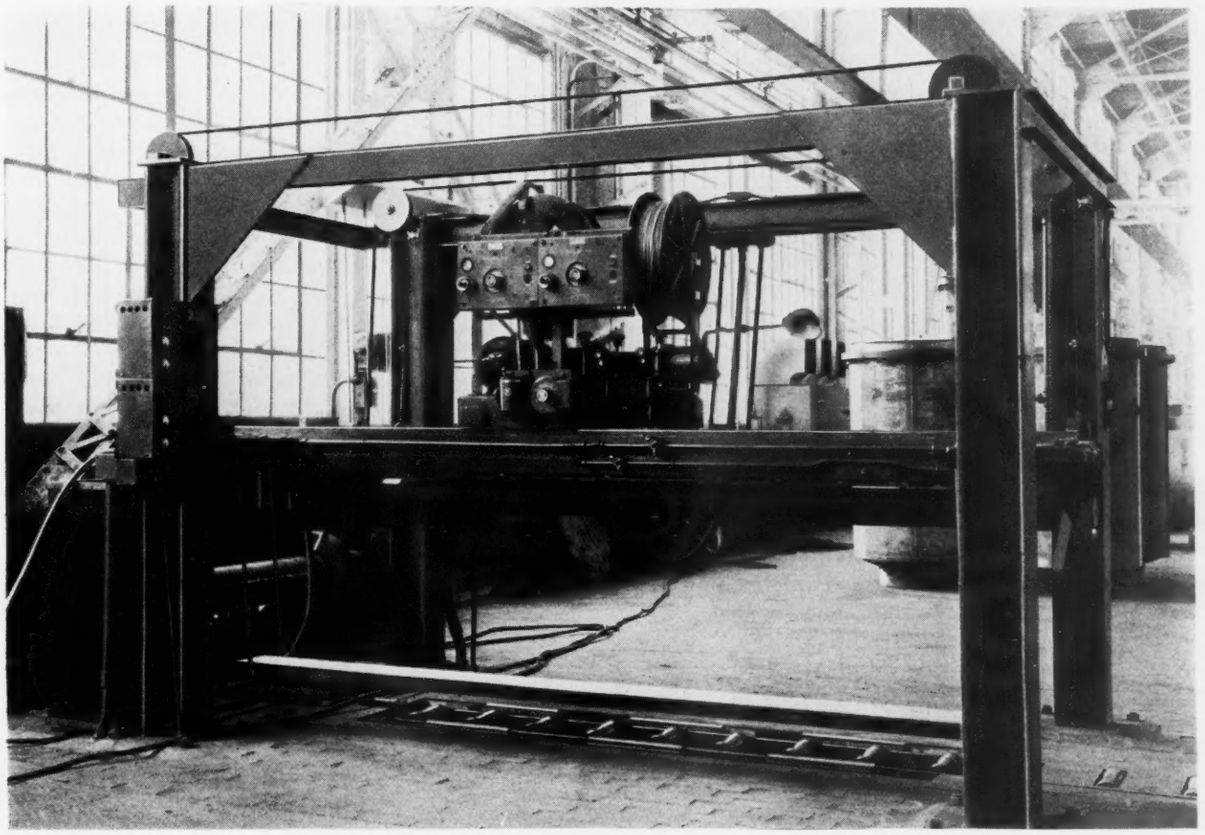


Fig. 3. Horn Type of Welding Machine that Simultaneously Lays Two Beads on Tanks up to 8 Feet in Length

Automatic welds are more uniform and less likely to leak than manual welds, owing to the fact that the machine holds a more constant arc than the most skilled hand welder. Also, automatic welds are made at a higher speed, because the work is not interrupted on account of fatigue of the operator or the necessity of changing electrodes. A smoother weld is another advantage.

Heavier currents can be used in automatic welding, and in some applications, it is possible for one operator to handle two automatic heads. The result is that a workman will deposit metal at from two to seven times the speed, when operating an automatic welding machine, that he can attain when welding by hand. The hand welder, however, usually has the advantage as far as time spent in handling the work before and after welding is concerned. He can frequently start the job without delay, while the operator of an automatic machine must spend some time in placing the tank in position. For this reason, every effort was made to design the automatic seam-welding machine used in this plant so as to facilitate loading and unloading.

The 8-foot horn-type machine shown in Fig. 3 does the seam-welding. A motor-driven winch, controlled by push-buttons on one of the columns, raises and lowers the welding mechanism. The work is rolled along the floor and on the ball-bearing rollers in front of the machine. After the machine has been adjusted to the desired height, the tank is pushed into the working position on the rollers between the machine columns.

It frequently happens that the tank must be rotated on its axis to bring the seam to the top. This is facilitated by a second set of rollers which are parallel with the axis of the tank. The rollers of this second set are raised by means of compressed air controlled by a valve near the push-buttons already referred to.

The work is held in position for the operation by air-operated clamps. Separate valves control the

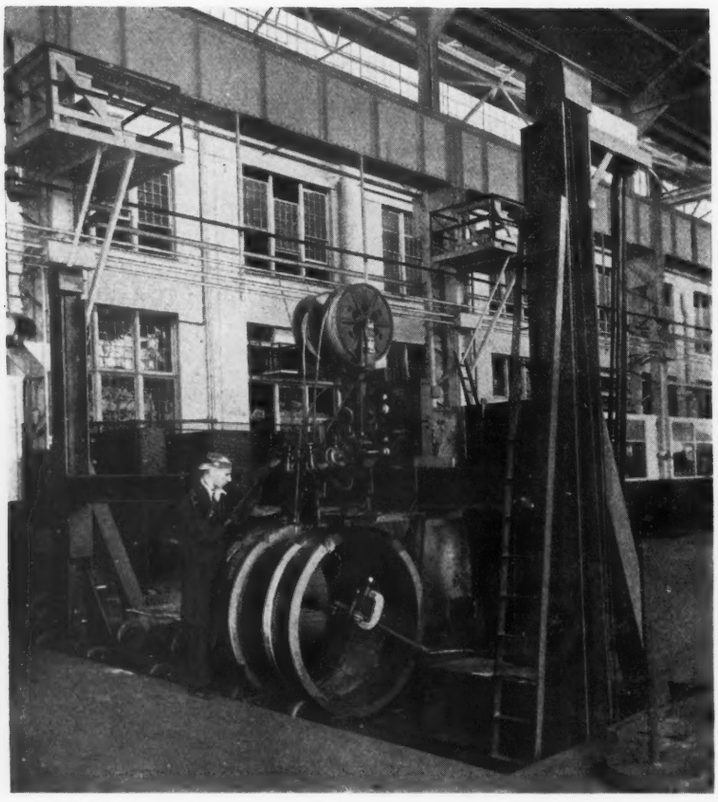


Fig. 4. Universal Machine with Oscillating Device Used in Making Butt Welds on Plate 3/8 Inch or More in Thickness

front and back clamps for convenience in welding tanks less than 3/8 inch thick that need not be tack-welded to hold the edges in the correct relation. When the welding is completed, the tank is removed from the machine and a second one is placed in position and clamped by the operator in about two minutes.

Two automatic welding heads located about 8 inches apart permit two beads to be laid at the same time. Using 3/16-inch wire in the first head and 1/4-inch wire in the second, a reinforced butt weld is made at the rate of 8 inches per minute between 5/16-inch plates. All controls for the speed, direction of travel, and welding current are within easy reach of the operator. Carriage speeds from 3 to 48 inches per minute are provided by an adjustable-speed motor and a three-speed gear shift. Current is supplied by two welding generators, one of 300 amperes and the other of 400 amperes rating.

The "back-up horn" is made of steel. Copper strips are set into its surface where the weld may come in contact with it. Some jobs require a flat copper strip, and others a strip having a groove under the weld to permit a certain amount of reinforcement on the inside. To provide for this, the horn is made cylindrical, with a variety of copper strips set into it, and is turned to bring the desired strip into the working position.

Longitudinal and Circumferential Seams Welded in One Machine

The universal welder shown in Figs. 2 and 4 is built along somewhat different lines, because it was designed to weld the longitudinal and circumferential seams on certain tanks without removing them from the machine. Furthermore, the horn-type machine requires a floor space more than twice the length of the longest tank in order to remove the tank from the horn. For work 10 feet in diameter and 16 feet long, which is the maximum capacity of the universal machine, a horn-type machine would require a floor space about 36 feet long. This would interfere with the flow of work in an orderly manner.

With the machine as it is now designed, the tank walls, prepared for welding, are rolled from the floor into the machine, with the loading bars raised

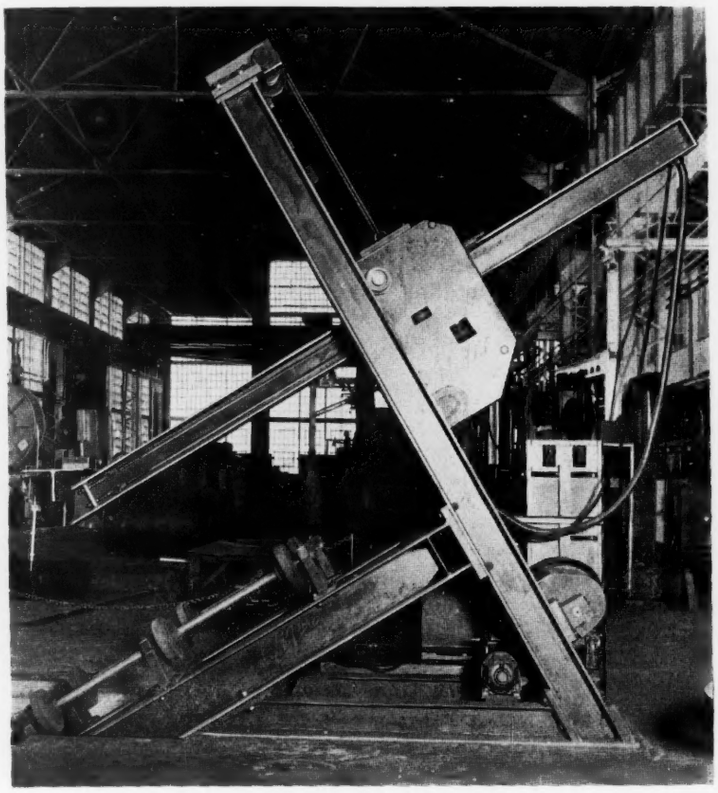


Fig. 5. An Inclined Type of Welding Machine Designed for Use on Tanks having a Flanged Head Telescoped into the Side

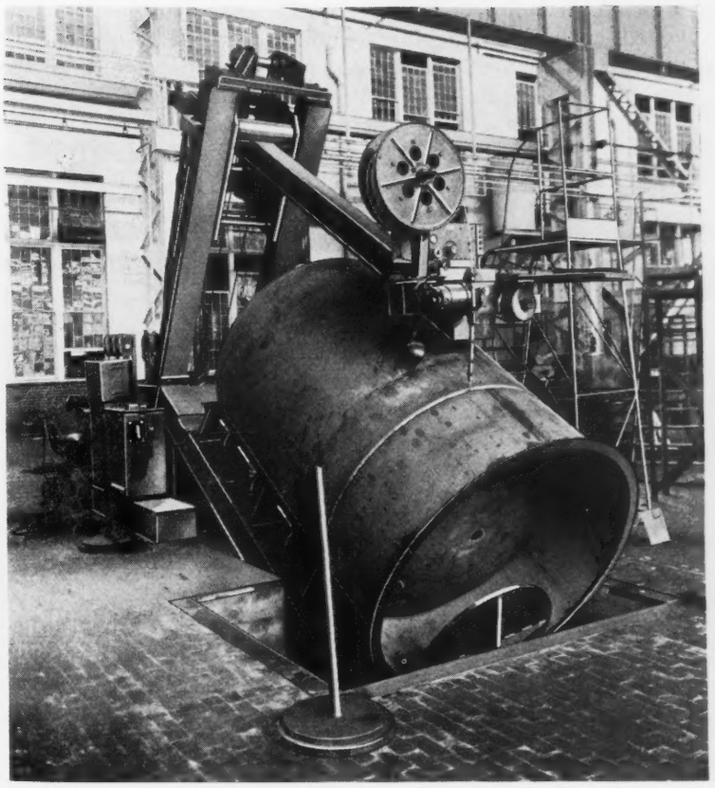


Fig. 6. The Inclined Welding Machine is also Equipped with an Oscillating Device and All Controls are Centralized

to the floor level, as shown in Fig. 2. The loading bars are then lowered to settle the tank on the rubber-tired wheels, ready for welding. When the welding is completed, the bars are raised by means of air cylinders and the tank rolled out on the opposite side of the machine, thus continuing the straight-line flow of the work. One man can roll tank walls along a smooth floor when their weight does not exceed from 2500 to 3000 pounds each. For heavier tanks, overhead cranes are available. The machine is designed with the cross-rail offset from the center about a foot, so as to clear the lifting chains of the cranes.

In welding large tanks, the operator sits on the seat at the right of the welding head and travels with it. All controls are within easy reach. Sometimes it is necessary to adjust the travel speed so as to compensate for slight variations in the vee that would give the weld more reinforcement at some points than at others. The centralized controls include those of rotation and longitudinal travel, as well as push-buttons which control the height of the cross-rail. The cross-rail must, of course, be set to the correct height to suit the diameter of the tank being welded.

For butt welds in plate 3/8 inch and more in thickness, better results are obtained if the electrode is oscillated, much as a hand welder "weaves" his electrode. Thus the machine is equipped with an oscillating device, which is started and stopped at will, and is so designed that the speed as well as the amplitude or width may be varied by the operator during welding without leaving his position.

In Fig. 2 the machine is shown equipped with one head, but experience has shown that two heads can be used to advantage on certain jobs. A second head and the weaving or oscillating device are shown in Fig. 4. Power is supplied by two 600-ampere single-operator generators, driven by one synchronous motor.

A Tank-Welding Machine that Holds the Work Inclined

When a flanged head is butt-welded to side walls having the same outside diameter as the flange, the universal machine is suitable for use, as both the

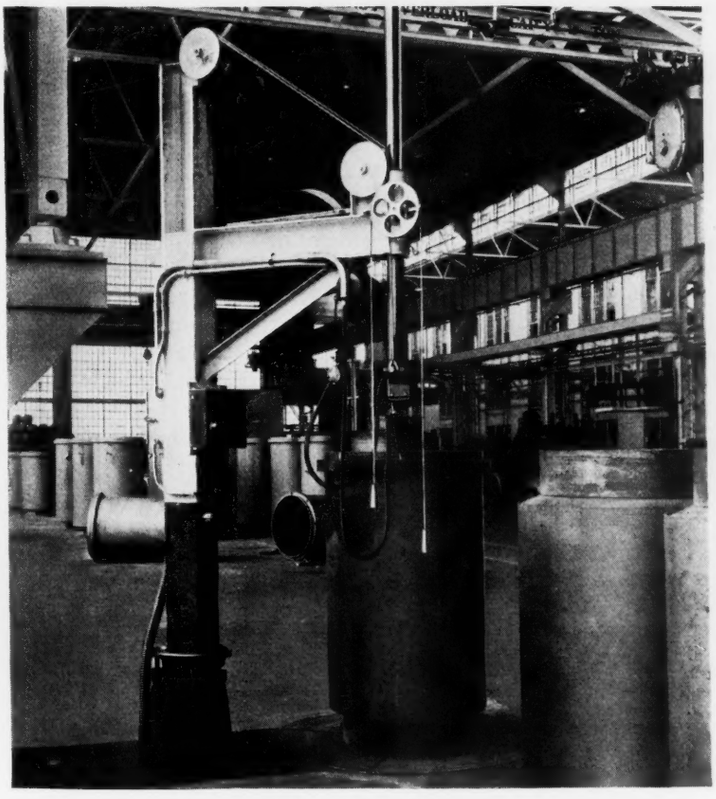


Fig. 7. The Bottoms of the Tanks are Welded in Place while the Work is Rotated on a Friction-driven Turntable

longitudinal and circumferential seam can be welded with this machine. However, when it is desired to telescope the flanged head into the side wall and unite them with a fillet weld, it is preferable to use a machine in which the tank can be inclined, so as to bring the pool of molten metal horizontal, if the fillet exceeds 5/16 inch. A machine designed to accomplish this is shown in Figs. 5 and 6.

The tank rests on rubber-tired wheels, all of which are driven at an adjustable speed. End thrust due to gravity is taken by a disk running on tapered roller bearings. The disk is set at a slight angle to the center line of the tank, so that it makes contact at the bottom only, and thus functions smoothly with a tank of any size within the range of the machine. Ground connection is secured by a cable clamped to the tank. This arrangement has been found to give a smoother arc action than when the tank is supported on metal wheels and the current is led in by a rolling contact against the mill scale on the tank steel.

This machine is also equipped with the arc oscillating or weaving device, and all controls are located conveniently for the operator. It was originally designed to weld both from the inside or the outside of a tank. However, the inspection requirements of tanks welded on this machine are so rigid that it is a great advantage to have all welds on the outside of the work.

A 1/2-inch fillet weld is made with one pass of the welding head at a speed of 4 inches per minute. In order to avoid leaks at the start, the weld is made about half size for a few inches by increasing the speed of the welding head. In finishing, the weld is lapped over at this point and the wire feed is stopped a few seconds before the current is cut off. This leaves no "crater," and avoids leaks.

The finished tank is tested with air pressure and liquid soap for minute leaks, and again with hot oil at a pressure representing approximately 75 per cent of the elastic limit of the steel. In the older type of tanks, the side wall extended to the floor and the lower head was welded around the inside about two feet from the bottom. With that design, it was very difficult to discover minute leaks at the weld, but in the new design all welds are visible when the tank is under test, and thus a high quality product is assured.

The machine shown in Fig. 7 is used for welding the bottoms in tanks of the type shown in Fig. 1. The table on which the work rests is level with the floor, so that light tanks can be placed on it and removed by hand. Heavier tanks are handled either by means of a jib crane, placed near the machine, or by a gantry crane which travels along the wall. Older machines of this type were modeled after boring mills, the table being driven by a large gear or worm. On account of the small amount of power required to turn the work, a friction drive has been found just as satisfactory.

The table is supported on three wheels running on tapered roller bearings. One of the wheels is driven by means of a standard gear and motor unit. Current is led into the work through the roller bearing and the rolling contact of the wheels. The high pressure that is exerted at the line of contact between the roll and the bearing race forces the grease out momentarily and provides a good metal path for the current.

All the machines described in the foregoing have been in daily use for a year, and have proved capable of producing welds of the highest quality at a considerable saving over hand welding.

Tapping 3549 Holes an Hour in a Demonstration at the Plant of the R. G. Haskins Co. in Chicago

* * *

Demonstration of High-Speed Tapping

More than three hundred representatives of manufacturers in many different lines recently witnessed a tapping demonstration that took place at the plant of the R. G. Haskins Co., 4636 W. Fulton St., Chicago, Ill. Twenty-one tapping machines were in operation, and thousands of parts lent by Chicago manufacturers for the purpose were tapped in the demonstration, which lasted all day.

The work tapped represented a variety of materials—aluminum die-castings, zinc-base die-castings, cold-rolled steel, Bakelite, and brass. Holes up to 1/4 inch in brass and up to 3/16 inch in steel were tapped.

The illustration shows an operation in which 3549 holes were tapped in an hour at a tapping speed of 3000 revolutions per minute and a return speed of 6000 revolutions per minute. The tap used was a No. 8-32, and the material, an aluminum die-casting. Numerous other examples of rapid tapping operations performed on other materials during the demonstration could be cited.

The Tool Salesman and His Job

The Buyer of Small Tools Expects the Salesman to Act as Technical Adviser as Well as Order-Taker

By C. B. COLE, President
Tool Equipment Sales Co., Chicago, Ill.

THE technique of selling small tools has changed considerably in the last few years. The selling of small tools is rapidly becoming more difficult for the salesman who lacks either practical or technical training. The ideal small tool salesman should have both. It is necessary for him to have a complete knowledge of the line or lines that he is selling, including the practical application of the tools. It is true that in calling on the purchasing agents, a definite knowledge of his line and sales ability are sufficient; but when he is referred to the tool supervisor, shop executive, or mechanical engineer, something more than sales ability is necessary.

The average shop man is reluctant to spend much time with a tool salesman who only knows what is contained in his catalogue. The shop executive soon discovers the limit of the salesman's knowledge, and generally judges the tool manufacturer by the caliber of the salesmen he employs. On the other hand, if the tool salesman is possessed of practical and technical experience, he is usually made welcome and gets a real opportunity to demonstrate his line. A great many shop men appreciate that a salesman of this type is an asset to them. They recognize that a salesman, in covering his territory, has many opportunities to obtain information in regard to the various tooling methods used by up-to-date manufacturing concerns, and that a shop executive can obtain this information by asking for suggestions on some of his problems.

Information obtained from salesmen has often proved valuable to concerns who have appreciated the fact that salesmen can offer helpful suggestions, not only on the application of the tools they are selling, but in some instances on the design of the customer's product. It stands to reason that a tool salesman who knows his business will be given the opportunity of looking over jobs in various shops, with an idea of making improvements on the existing tools; and when a new device is to be put into production, it is always the tool salesman who has real mechanical ability that is called in on the job. This means orders, not alibis.

Can a Good Mechanic be a Good Salesman?

It has often been remarked that good mechanical men do not make good salesmen. However, this statement is not always true. There is no reason why a good mechanical man cannot develop into a good salesman, provided he has common sense and is given proper instructions. That some mechanical men do not make good salesmen is the fault of the sales manager rather than of the men.

It is impossible for a man to be a good sales manager by sticking at his desk in the office. It is absolutely essential for a sales manager to be out in the field at frequent intervals, to become acquainted with the conditions with which his salesmen are confronted, and to learn first-hand just what their customers are demanding in the way of design, service, etc. The sales managers who possess this knowledge will more readily appreciate the fact that, in order to sell tools successfully today, it is necessary for the salesmen to have mechanical as well as sales ability.

It seems evident, therefore, that the tool manufacturer who wants to obtain his share of the business in the future will either have to employ salesmen who have real mechanical ability, or have a sales engineer follow up the salesmen's calls. This, of course, is expensive, and is not satisfactory. When two men are calling on a prospective customer, the man being interviewed is generally on the defensive, as he feels that anything he may say may be distorted by having two entirely different versions of the interview. It is also true that a great deal of time is wasted when two men attempt to call on the customer together, as one or the other is always trying to put over his side of the story. Sometimes, when a difficult problem is encountered, it is necessary to have two men call together. In that case, the second man usually is a factory man or a recognized expert in his line.

The Entire Organization May Help or Hinder Sales

The salesman, however, is not the only man that helps to bring in the orders. Cheap help in either office or factory may counteract his efforts. Such help is the most expensive in the end. The damage done by some clerk in entering an order incorrectly cannot be readily estimated. Often it causes the loss of a valuable customer, and good customers are hard to get at any time. Errors of poor shipping clerks have been the cause of alienating the affections of many good customers.

The effect of poor workmanship, which is not apparent until the customer discovers it, is another argument against cheap help. But the very easiest way to lose business is to employ cheap salesmen. One of these can do more damage in one month than several topnotch salesmen can repair in two. High-pressure salesmen cannot sell small tools or any product that depends on repeat business. One order, and then they are through, because of the extravagant promises or wild guesses that this type of salesman often makes.

The Equipment of an Industrial X-Ray Laboratory

By CHARLES O. HERB

THE advantages afforded by X-rays for determining the quality of castings, forgings, welds, and materials in general are becoming well known throughout industry. Not only do radiographs, or X-ray pictures, provide a non-destructive method of inspecting the inside of parts, but they furnish also a means of research, leading toward better manufacturing practices that result in products of higher quality. These advantages are available to manufacturers in the Middle West through the X-ray laboratory facilities of the Robert W. Hunt Co., Chicago, Ill., by means of which it is possible to "look through" steel up to 3 1/2 inches thick and through aluminum or similar light-weight material up to 8 inches thick.

A railroad siding leads to within 50 feet of the laboratory, on the same floor level. Thus, in cases where the work is too large to enable it to be removed conveniently to the X-raying room, the necessary equipment can be taken to the freight car. X-ray exposures of this kind are made at night in order to avoid affecting employes with the rays.

Fig. 1 shows a view of the machine room with its rectifier, stabilizer, and accessories. The control board is just outside the door. When this equipment is in use, the operator has a clear view of it through the glass window.

To protect the operators, all exposures, except in unusual cases, are made in the lead-lined room illustrated in Fig. 2, as the X-rays cannot pass readily through lead. Both the walls and the ceiling are covered with two layers of lead sheets, 1/16 inch thick. All the nails used for fastening the lead sheets are also covered with lead. The windows, like the one seen at the left in Fig. 2, through which the X-raying operation is observed are made of leaded glass. This room is approximately 14 by 18 feet in size.

For taking radiographs, the 200,000-volt Coolidge lamp seen in Fig. 2 is used. A smaller 88,000-volt tube, illustrated in Fig. 6, is employed in studying grain size and metal strains by making Von Laue diffraction patterns of crystals, as will be explained later. Radiographs are made on negatives up to 14 by 17 inches in size.

A Dark Room that Belies its Name

In days gone by, the dark room of photographic establishments in which the plates or films were developed were dark and gloomy affairs that lived up to their name. The walls and ceilings were painted black and the room was lit only by a faint light entering through colored glass.

Such rooms are no longer necessary in developing photographic negatives or prints. In the "dark room" of the Hunt X-ray laboratory, the ceilings and walls are painted with "Ruby Light" paint. They are a light buff and reflect the red photographic light with a high degree of efficiency. When X-ray negatives are being developed or prints reproduced, this room is illuminated with an Agfa filter lamp that floods the entire room with a soft light of sufficient intensity to enable objects to be seen readily.

Fig. 3 shows a corner of this room. Films in the process of being developed are mounted in metal frames, such as that seen in the man's hand, for immersion in the developer, water rinse, and hypo tanks. In this way, the negatives are kept separate in the baths and become fully developed without streaks or other defects.

In back of the developing tanks, there is a ground glass that is lighted from the rear so that the films can be observed in the various stages of the developing process by holding them in front of the glass and looking through toward the light. This dark room is of sufficient proportions to allow the man to work without feeling cramped for space.

Negatives and Prints are Dried in an Oven

Between the "dark room" and the laboratory office seen in the heading illustration, an electric oven has been installed for drying the negatives and prints. This oven can be seen in the background of the heading illustration. The films are placed in the oven mounted on the metal frames used in the developing process. A fan circulates the heated air through the oven.

Stereoscope for Studying X-Ray Films

At the left in the heading illustration is a stereoscope which provides a means of determining approximately the depth of any defects indicated by the X-ray pictures of a casting or other part. First, two X-ray pictures of the part are taken at slightly different angles. After these films have been developed, one is placed in the illuminated frame at the left-hand end of the stereoscope and the other in a similar frame at the opposite end. Then the two small mirrors in the center are adjusted to reflect the images of both films so that, to an observer standing directly in front and looking simultaneously at both mirrors, there appears to be but one reflection. The part that has been X-rayed then appears to stand in relief, and the location of

Fig. 1. The Control Board and Machine Room in which an Electric Current up to 200,000 Volts is Obtained for Taking X-Ray Pictures

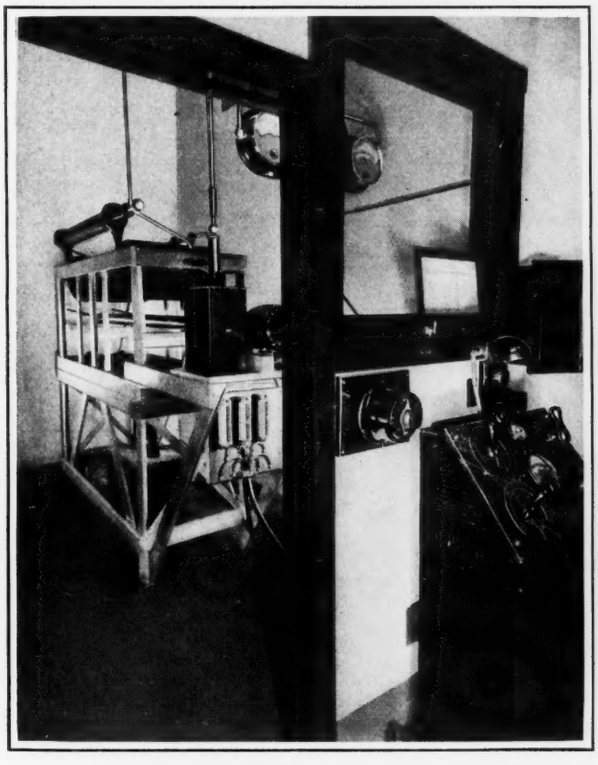


Fig. 2. All the X-Rays are Confined to the Room in which the Exposures are Made by Covering the Walls and Ceiling with Sheet Lead

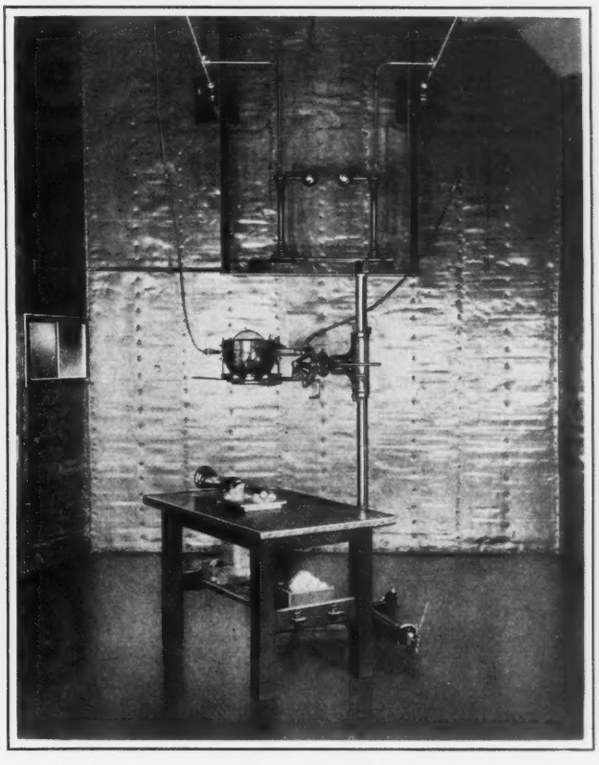


Fig. 3. The "Dark Room" has Walls of Light Buff for Efficient Light Reflection

defects can be determined with respect to the front or back of the object.

X-Rays Also Show Strains in Metal

The use of X-rays for "seeing" into metal parts to determine the existence of defects has, as mentioned at the beginning of the article, become fairly well known. There is, however, another important use for X-rays that is not so generally known. This is in determining the internal strains and relative crystal sizes in metal parts by passing X-rays through a crystal of the part, so as to obtain a Von Laue diffraction pattern. Several of these patterns are shown in Figs. 4 and 5.

For such an investigation, as thin a test piece is cut from the part as is possible without imposing working strains on the specimen. Then the test piece is etched to a razor-like edge to remove all mechanically worked metal. This extremely thin edge is placed over an aperture, only a few thousandths of an inch in diameter, in the unit illustrated in Fig. 6. Parallel X-rays passing through this aperture are diffracted or separated by the crystal of the razor-like edge above the aperture. The diffracted light is recorded on a photographic film in the X-ray unit. A voltage of about 75,000 is used for these investigations.

The diffraction pattern at the left in Fig. 4 shows a crystal of a low-carbon steel casting in a completely annealed condition. This is indicated by the size and intensity of the spots surrounding the central black area and their random orientation.

The pattern at the right in the same illustration, which also shows a crystal of low-carbon cast steel, has an extreme streakiness. This indicates that

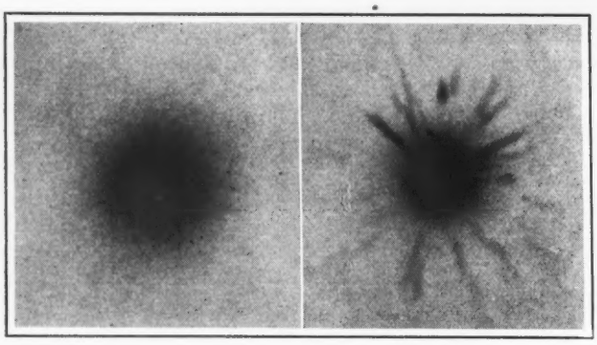


Fig. 4. Two Diffraction Patterns, One Indicating a Completely Annealed Metal Crystal, and the Other, a Crystal Having Large Grain Size and Unequal Directional Strains

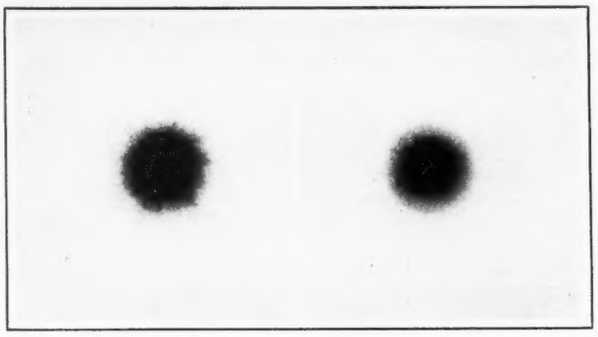


Fig. 5. Two Diffraction Patterns of Rolled Tool Steel that Indicate a Small Grain Size. One Shows Directional Strains Just Starting; in the Other, They are Entirely Absent

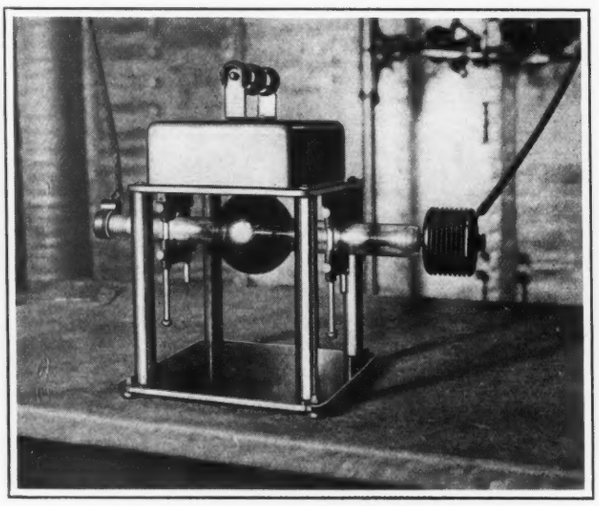


Fig. 6. An 88,000-volt Coolidge Tube Used in Making Von Laue Diffraction Patterns

strains in the metal follow certain lines more strongly than others. The difference in the intensity of the lines indicates greater and lesser strains. The length of the lines or the distance that the spots can be observed from the center of the dark area gives an indication of the grain size. If the grain size is unsatisfactory, this can be remedied by annealing.

Diffraction Patterns of Rolled Tool Steel

At the left in Fig. 5 is shown a diffraction pattern of from 0.85 to 0.90 per cent carbon rolled tool steel. This pattern shows that the metal was rolled until directional strains just started. The grain size is small, as indicated by the short lines.

The pattern at the right in the same illustration is that of a crystal of rolled tool steel that had been hardened but not tempered. This pattern indicates, by the uniform intensity around the central spot, that the metal is strained equally in all directions. In this case, also, the grain size is small.

* * *

German Machine Tool Exports

According to *Commerce Reports*, the German export trade in machine tools during 1931 was well maintained. In the first nine months of 1930, the exports of metal-working machinery were valued at approximately $37,500,000; the same exports during the first nine months of 1931 were valued at slightly more than $40,000,000. Shipments of metal-working machinery from Germany to fourteen important foreign countries showed considerable increases. Imports of metal-working machines fell during the same period from a value of approximately $2,200,000 to $1,300,000.

The two outstanding markets for German metal-working machinery in 1931 were Russia and France. The Russian purchases amounted to considerably more than one-third of the total exports, while the exports to France accounted for about 23 per cent.

* * *

The proposed American tentative standard for lock-washers has been released by the committee that has developed it, for general criticism and comment. Those who wish to examine this proposed standard with a view to transmitting comments to the committee may obtain copies from C. B. LePage, assistant secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York.

Getting Better Results from High-Speed Steel

The service rendered by high-speed steel tools and cutters can be greatly improved by more careful heat-treatment than is practiced in most shops. Large users of high-speed steel employ methods that are giving excellent results, but this cannot be said to apply generally to the smaller shops. The author of the article "Obtaining Better Results in Hardening High-speed Steel," to be published in March MACHINERY, has had a long experience as demonstration- and trouble-man for a large steel mill making high-speed steel. This has kept him in daily contact with hardening problems. From this experience he has gathered some very definite data. His article will assist the shop superintendent in obtaining maximum efficiency from high-speed steel tools and cutters.

Machine Tool Exports to Great Britain

During 1930, Great Britain imported machine tools to the value of $8,537,000, or on an average of $711,400 per month. Of this total, the United States supplied nearly 48 per cent, the actual value being $4,072,000, representing a monthly average of $339,000. The exports from the United States to Great Britain were made up as follows: Drilling machines, $395,000; grinding machines, $823,000; lathes, $579,000; milling machines, $669,000; planing and shaping machines, $195,000; presses and punching and shearing machines, $362,000; and other machines, $1,048,000. The average value per ton of these machines was $1090.

During the first ten months of 1931, Great Britain's imports of machine tools totaled $6,240,000, representing a monthly average of $624,000. The imports from the United States amounted to $3,624,000, or a monthly average of $362,400. It is remarkable that not only the United States' figures represent a much higher proportion of the total during the first ten months of 1931 than during 1930—nearly 60 per cent, as against 48 per cent last year—but the monthly average actually shows an increase of nearly 7 per cent, whereas imports into Great Britain, as a whole, show a decline of more than 12 per cent.

It is also worthy of note that the United States sent to Great Britain, during the first ten months of 1931, presses and punching and shearing machines weighing 3867 tons and having a total value of $1,144,600, whereas for the whole of 1930 the totals under this heading were only 921 tons and $362,000. The large tonnage of presses and punching and shearing machines has had the effect of reducing the average ton-value of machine tool exports to Great Britain from this country in 1931 to $650.

* * *

Meeting of Steel Founders' Society

The annual meeting of the Steel Founders' Society of America, Inc., was held at the Stevens Hotel, Chicago, Ill., January 20-21. Among the addresses made at the meeting may be mentioned "Firm Bidding," by Arthur Simonson, Falk Corporation, Milwaukee, Wis.; "Merchandising and Prices," by Walter Buchen of the Buchen Co., Chicago, Ill.; and "The Use of Steel Castings in Welded Structures," by J. G. Ritter, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Designing Close-Fitting Die Sets for Punching Thin Stock

By H. R. SCHMIDT

Accurate Alignment of the Punch with the Die is Assured, and Shearing of These Members is Avoided by Having Guide Pins Fixed in the Punch-Holder Instead of in the Die Member as is the More Common Practice

DIE sets for punching thin stock must be made with very little or no clearance between the punch and the die in order to produce accurate work. Even when the die set is carefully aligned and fitted, there is still another factor to be considered, namely, the alignment of the ram with the bed of the press. A small error in the alignment of these members may spring the die set enough to cause shearing of the punch and die.

Fig. 1 shows what takes place when a conventional die set with the pins at the rear is used on a press on which the ram is not in accurate alignment with the bed. When the shank of the die set is gripped in a ram that is out of line, the punch moves on an arc having a radius *AC*, and may pass over the edge of the die as shown, the center line of the punch making an angle *E* with the center line of the die set. In this case, the center of rotation is at the point *A*, which is also the center of the pins in the bushings.

In Fig. 2 is shown a die set similar to the one shown in Fig. 1, except that the guide pins *P* are fastened in the punch-holder and are a sliding fit in bushings in the base. The base is machined to bring the face of the die and the center *O* of the pin bearings in the bushings on the same center line or plane *C–C*. (A similar arrangement applied to the stagger type of die set shown in Fig. 5 makes the point *O*, or the end of the punch, the fulcrum point that must always stay in line with the die. Thus, any misalignment of the ram with the bed of the press will only affect the upper part of the die set, leaving the cutting end of the punch in line with the die.) This practice of fastening the guide pins in the punch-holder instead of in the die member is a point that may prove helpful to die designers.

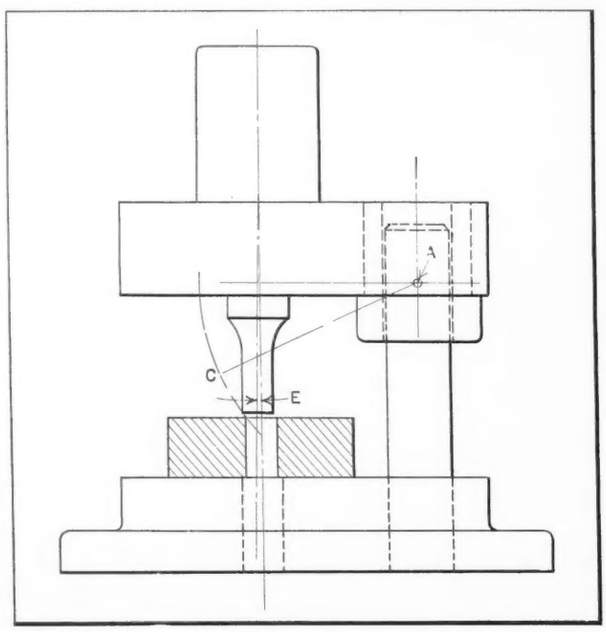


Fig. 1. Diagram Showing How Shearing of Conventional Die Set Occurs when Punch is Tilted by a Ram that is Out of Line

The arrangement shown in Fig. 5 has been used very successfully by the writer and by others to whom he has suggested the idea. However, the arrangement is not offered as a criticism of the many excellent dies made with the guide pins fixed in the base, but is given rather as a point in designing which may

H. R. SCHMIDT obtained his technical training at Temple University and from the International Correspondence Schools. He learned the machinist's trade during four years at the F. J. Stokes Machine Co. in Philadelphia, makers of pharmaceutical machinery. After having finished his training, he left this company in 1911, and a year later found himself in charge of a jobbing machine shop. Tool- and die-making, however, appealed more to him, and he returned to this branch of the industry. He became an expert in experimental and development work, and for three years was engaged in developing tools and machinery for radio equipment, when that industry was in its infancy. Five years ago he turned from tool-making to tool design. Later he became assistant foreman in the tool-room of a large plant making metal sash. For the last twenty years he has been in close contact with a great variety of difficult problems in tool, die, and special machinery design.

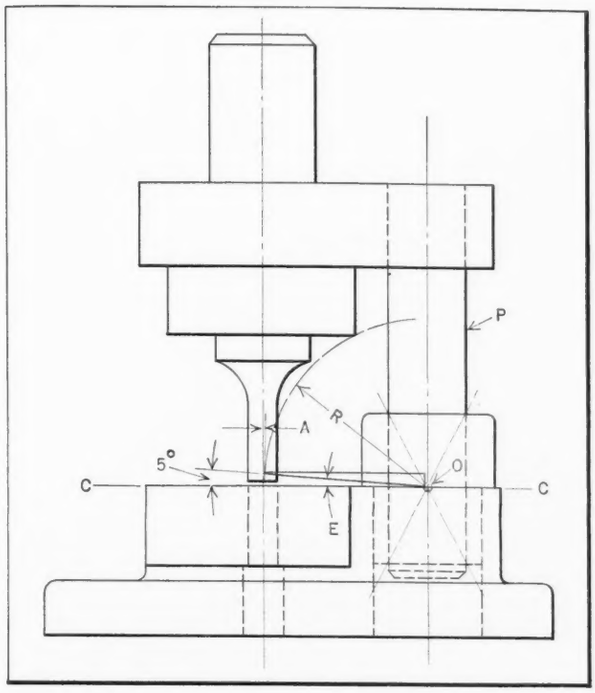


Fig. 2. Die Set with Guide Pins Fixed in the Punch-holder to Minimize Shearing Due to Misalignment of Ram

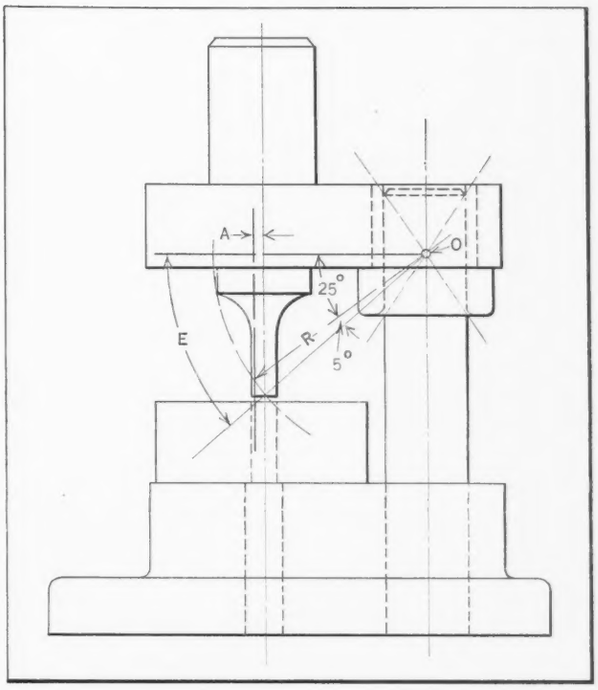


Fig. 3. Diagram for Calculating Amount of Shear that would Occur if Punch in Fig. 1 were Tilted 5 Degrees

facilitate the construction of dies to meet many specific requirements, and which may well be kept in mind by die designers.

In Fig. 4 is shown a die set with staggered guide pins that are tight in the base. In this case, the punch will tend to pivot about the point *O* as a fulcrum if the ram and bed of the press are out of alignment. From this illustration, it is obvious that a slight misalignment of the ram and the die base may cause serious shearing of the punch and die.

In Fig. 5 is shown a die with staggered guide pins that are fixed in the punch member. The ad-

Fig. 4. Diagram for Calculating Shear of Die Set with Staggered Guide Pins when Pins are Fixed in Base or Die

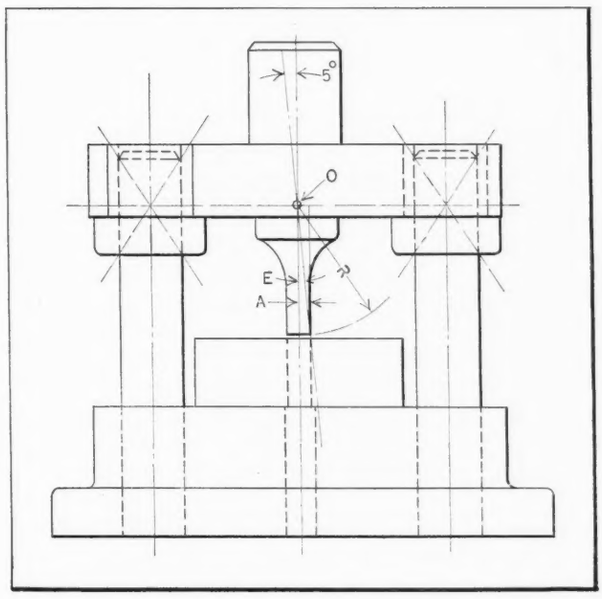
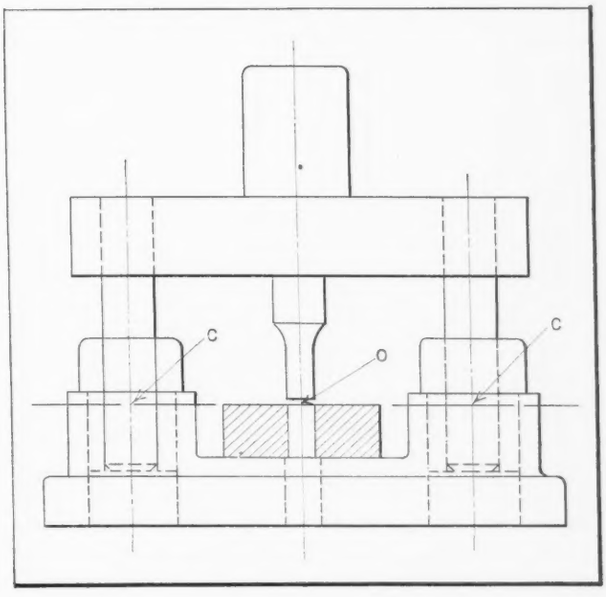


Fig. 5. Die Set with Staggered Guide Pins Fixed in Punch Member so that Tilting of Punch will not Cause Shearing



vantages of this arrangement over that shown in Fig. 4 will be readily understood, in view of the comparisons made in the arrangements shown in Figs. 1 and 2.

The advantages of having the bushings in the base and the guide pins fixed in the punch-holder are emphasized by the following calculations:

If a triangle is drawn, as shown in Fig. 3, it is apparent that the misalignment or motion of the punch varies as the cosine of the angle E. Let us call the angle E 30 degrees when the punch is in line with the die, and let us call the angle E, Fig. 2, zero. Now, if we could strain the die set sufficiently to move the punch, or tilt it, say about 5 degrees, the punch would move out of alignment with the die an amount A, Fig. 3. Thus we have:

$$A = (R \times \cos 25 \text{ deg.}) - (R \times \cos 30 \text{ deg.})$$

For the purpose of comparing the effect of tilting the punch at an angle of 5 degrees in the three cases illustrated in Figs. 2, 3, and 4, let us assume that $R = 1$ inch. Then, in the case of Fig. 3 we have:

$$A = (R \times 0.90631) - (R \times 0.86603) = 0.0428$$

In the case of Fig. 2, where the guide pins are fixed in the punch-holder, let us assume that the punch is also tilted 5 degrees, so that we have:

$$A = (R \times \cos 0 \text{ deg.}) - (R \times \cos 5 \text{ deg.})$$

Now, since $R = 1$ inch,

$$A = (1 \times 1.00000) - (1 \times 0.99619) = 0.00381$$

The conditions are the worst in the case of the die set shown in Fig. 4, where the guide pins are staggered, that is, arranged diagonally on the base. In considering angle E and the amount of misalignment A, it is assumed that the guide pins and the punch are all in the same vertical plane and that angle E and the misalignment A are also measured in this plane, which extends diagonally across the die, although this is not apparent in the illustration. In this case, the fulcrum or pivoting point is at O and a movement or tilt of 5 degrees would give:

$$A = R \times \sin 5 \text{ degrees}$$

As $R = 1$ inch, we have,

$$A = 1 \times 0.08715 = 0.08715 \text{ inch}$$

Now, considering the set with staggered pins tight in the punch-holder, as in Fig. 5, where the face of the punch is on the fulcrum point, any calculation of motion will have to be for the shank or stem of the punch-holder, which can move a considerable amount without bringing the face of the punch and the die opening out of alignment.

National Machine Tool Show to be Held in Cleveland

The National Machine Tool Builders' Association has announced that the third National Machine Tool Show will be held in Cleveland, September 10 to 17. The exposition will be held in the buildings of the Cleveland Public Auditorium, the same as in former years. So far, 61,000 square feet of display space, exclusive of aisles and registration quarters, have been contracted for by members of the Association.

This indicates that the third machine tool exposition will, in every way, match the second show, which was held in 1929; and by the time additional exhibits are included, it will quite likely exceed the last exposition in number of exhibitors and exhibit space.

According to the rules of the Association, machine tools may be exhibited only by members in good standing since September 1, 1930. Machine tools are defined by the Association as "power-driven complete metal-working machines, not portable by hand, having one or more work-holding devices, used for progressively removing metal in the form of chips."

Applications for the following types of exhibits will be considered by the exhibition committee, care of Roberts Everett Associates, 225 W. 34th St., New York City: Metal-working machinery other than machine tools; accessories used in the operation of machine shops; managerial services; and engineering and business journals.

The National Machine Tool Builders' Exposition has become a show of international importance. In 1929 it was visited by more than 20,000 people identified with the mechanical industries and representing not only the entire industrial area of the United States, but a great many foreign countries. At that time there were more than 250 exhibits. Ralph E. Flanders, manager, Jones & Lamson Machine Co., Springfield, Vt., is chairman of the Exposition Committee.

* * *

Objects of Foreman Training

In a paper on foremanship training read before the annual meeting of the American Society of Mechanical Engineers, U. J. Lupien, assistant manager of the Industrial Relations Division, Cheney Bros., South Manchester, Conn., enumerated the following points as the objects of foreman training: (1) To acquaint the foreman with the labor policies of the company; (2) to enable him better to understand the functions of management, so that he may cooperate to a maximum degree and also receive from the various phases of management the maximum assistance; (3) to better fit him for the most important phase of his job, the handling of help; (4) to develop his ability to think and to analyze situations; and (5) to impart knowledge of a technical nature.

What is Wrong with Drafting-Room Standards?

An Examination into the Reasons Why Mechanical Drafting Has not Kept Pace with the Progress Made in Other Departments of Manufacturing Enterprises

By J. S. DRAGO

MANUFACTURERS frequently complain of the high cost of drafting work, while draftsmen complain of their low pay. Strangely enough, both complaints appear to be justified. In the case of special machines, often more than half of the total cost goes into the designing and drafting work. On the other hand, draftsmen, many of whom have obtained an expensive technical education, are not highly paid. This contradictory condition is not caused by the present industrial difficulties, but has persisted throughout the upward as well as downward swings of the industrial pendulum.

What are the causes of this condition? Two of them may be stated as follows: (1) There is no real standardization in drafting-room practice; (2) mechanical drafting is hedged around with obsolete traditions.

On the question of standardization, the present rule seems to be: "Every concern for itself." Most drafting-rooms have their lists of regulations for making drawings. The exact wording of notes to be placed on them, the method of showing sections, the location of dimensions and dimension lines, the style and slant of the lettering, the use or the omission of inch marks, the representation of screws and threaded holes, etc., are outlined in detail, and every chief draftsman seems to have a different idea as to how these representations should appear on a drawing. That which is strictly required in the drafting-room of one firm may be strictly tabooed in another.

In some drafting-rooms these lists of regulations, commonly called "Sheets of Standards," cover almost every element of drafting. A few regulations may be necessary, but most of them represent only the opinion of one man. Sometimes the rules are downright silly. The following examples may be cited: In the drafting-room of one concern, if a man were to print on his drawing "Countershaft used only when specified on sale," he would have to correct that note to read "Countershaft used only when called for on sale." In another drafting-room it is against the rules to print "Drill 2 holes for 3/8-inch bolts"; it must be worded "Two holes, drill for 3/8-inch bolts."

In time, the force of habit convinces the chief draftsman and the other older men in each drafting-room that their particular rules are the best. No matter how unimportant or even foolish some of the rules may be, habit makes them look not only right but irreplaceable. The result is that the "Sheet of Standards" becomes a veritable Chinese wall built around the drafting-room, isolating it from all outside influence. When a new man enters the service of such a company, even though he has been an efficient draftsman for ten or twenty years, he must be willing to forget all of his drafting habits and acquire a brand new set. As he starts to work, his mental reaction is similar to that of a self-conscious inexperienced guest at a formal reception; he hesitates at every move, wondering if he is doing the right thing or if he is committing an inadmissible error.

Some executives believe that their standards save time over the methods that the men would use if no rules were laid down. In one of the largest drafting-rooms in the country this claim is made. However, it takes a new man almost a year to get into the swing of the system, which means that for the first year the standards make him lose time instead of saving it.

Assuming that the system really does save time when a man is used to it, it will take all of his second year to even up the loss caused in the first year. Hence, not until the beginning of the third year does the system cause a net saving. With draftsmen changing jobs as often as they do, and with almost every concern having a different idea as to how drawings should be made, it is doubtful if individual plant standardization actually saves time.

Besides hampering the draftsman in his work, these standards cause a great deal of unnecessary correction. This is discouraging and causes loss of interest in the job. To try to save time and improve a draftsman's work with a great many rules is less effective than to try to conserve his interest by omitting them. If a shop man can read at all, he should be able to read a note on a drawing in vertical letters as well as in slanting letters.

A committee of the American Society of Mechanical Engineers is at present engaged in formulating a simplified code of drafting standards. The universal adoption of one set of standards would permit every draftsman to learn the rules of drafting-room practice once and for all. He would be ready to make drawings according to the rules the first day that he entered a new drafting-room.

In the meantime, every chief draftsman might be less insistent on individual standards for making drawings. Few draftsmen are likely to use freakish methods in their work, and if they did, they would easily be caught by the checker. Let us specify to the draftsman our individual standards for machine construction and machine production, but let us stop hampering him with regulations concerning the rudiments of mechanical drawing.

In another article, the author will discuss another burden on both the draftsman and the firm employing him—the clinging to obsolete traditions.

Notes and Comment on Engineering Topics

Glass-lined tank cars for the transportation of milk have been introduced on the Great Western Railway of England. Each car has a capacity for 3000 gallons of milk.

An interesting and practical application of the photo-electric tube—the electric eye—has been made by the Logan Conveyor Co., Louisville, Ky., as recorded in a recent number of the *General Electric Review*. In many conveyor installations, it is necessary to switch the product from one conveyor line to another. The Logan company's method is to place two small "flags" or projections in different positions on each container carrying material over the conveyor line. One photo-electric relay and two light sources are placed near each switching point in such a manner that only flags in predetermined positions will intercept the two light beams simultaneously. The illustration indicates the general arrangement. The relays operate switching equipment which sends the moving material to its proper destination.

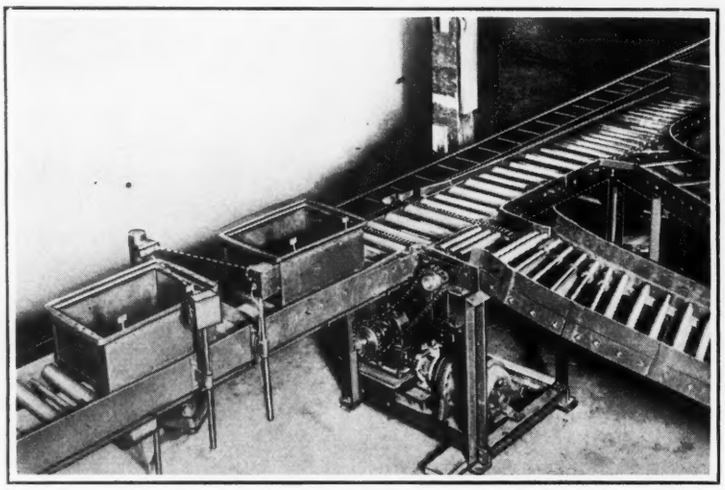


Photo-electric Relay Equipment and Automatic Switching Mechanism that Selects the Path of Tote Boxes on a Conveyor System in Accordance with the Position of Metal Flags on the Boxes

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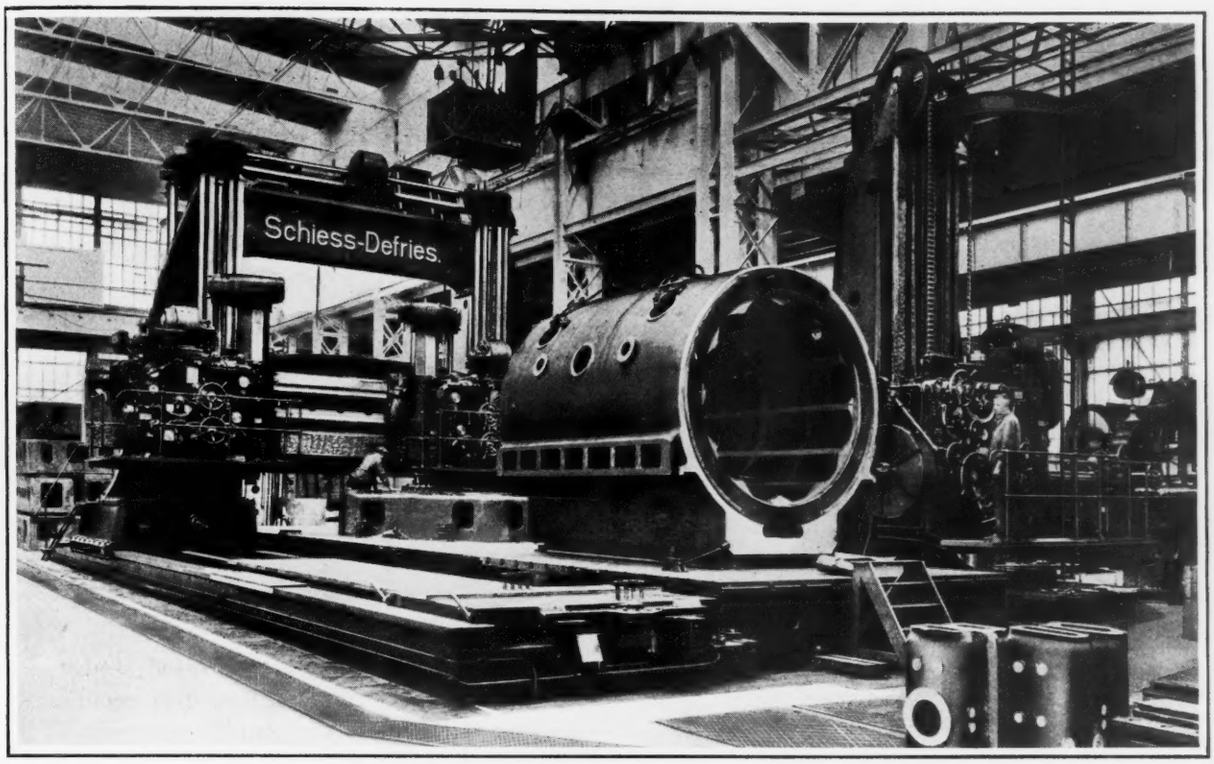
At a recent visit to the Westinghouse Research Laboratories at East Pittsburgh, Pa., a demonstration was made of a German device by means of which currents of clean, clear air can be seen as if they were luminous. If the hand is held in the path of vision, the eddying currents of air set up by the heat of the hand can be easily seen, and a burning match appears to be surrounded by a boiling whirlpool of air currents. Photographs of air currents can also be made. The real object of the device in the Westinghouse laboratories is to study the eddies in the steam flow through the blading of steam turbines. Whether such eddies exist or not has hitherto been a matter of speculation; but with this device, it will be possible to determine exactly how gases behave when impinging upon the turbine blades.

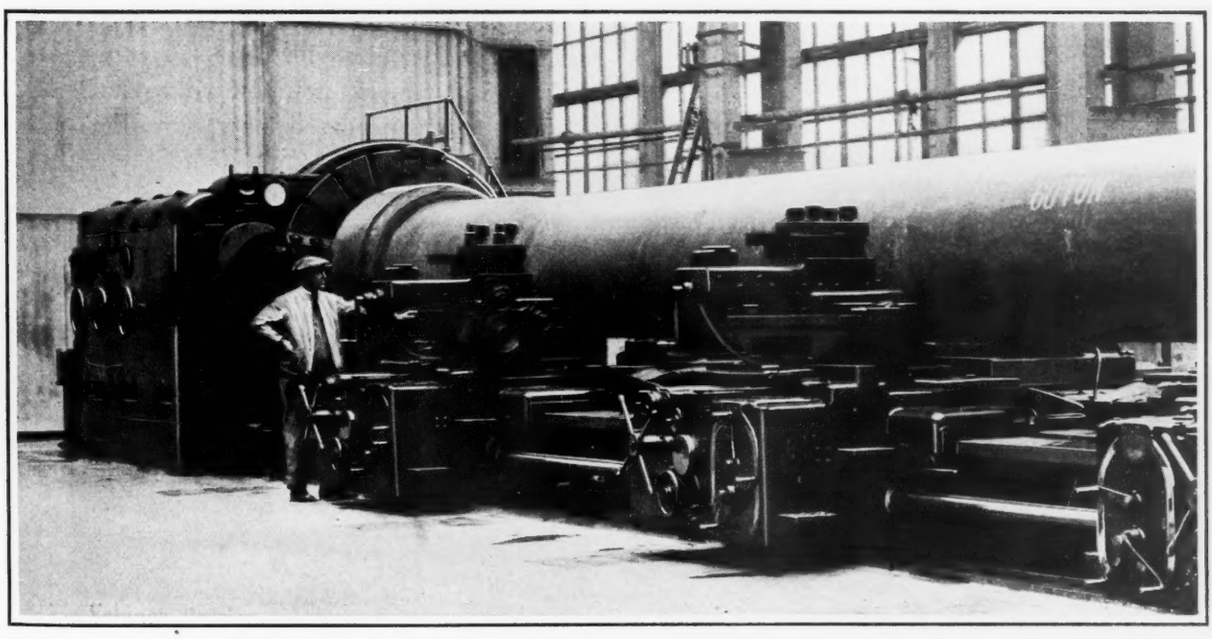
The cable system of street railway traction, which was quite generally used at one time, is now employed only in exceptional instances, one of these being the subway in Glasgow, Scotland. This subway forms almost a circle, seven miles long. A continuous wire rope, seven miles in length, was recently supplied for the subway by the Whitecross Co., Ltd., of Warrington, England. The rope consists of six strands of nineteen wires each, arranged around a manila rope core. Individual wires 1 1/4 miles long are joined by a special brazing process, the joints being carefully spaced with long intervals. The total weight of the rope is 56 1/2 tons. Probably this wire rope is the only one of its kind in use anywhere in the world.

Exhaustive tests have been concluded at Purdue University, Lafayette, Ind., on a four-wheel-drive truck made by the Four Wheel Drive Auto Co., Clintonville, Wis. Some of the results of the tests are as follows: Running at a speed of about 28 miles per hour, the brakes were applied and the truck stopped within its own length. The truck has climbed grades of 78 per cent, and indications were that it could have climbed steeper grades had not the flow of gasoline been cut off because of the angle at which the carburetor was tipped. It is stated that on a level road, 11.8 per cent of the power developed by the motor was required to operate the dead weight of the truck, while 88.2 per cent was used for moving or hauling the load.



(Above) A View in a German Machine Shop, Showing a Schiess-Defries Combination Milling, Boring, and Drilling Machine, Operating on a Steam Turbine Housing. The Working Width between the Columns is 15 Feet, and the Length of the Bed 60 Feet. The Milling Heads, Mounted on the Cross-rail, are Each Driven by a 25-horsepower Motor. The Maximum Height under the Spindles is 14 Feet 9 Inches. The Horizontal Boring and Milling Machine Shown on the Right-hand Side of the Work is a Part of the Combination Machine. The Total Weight is 470 Tons

(Below) A Heavy Lathe in the Schiess-Defries Shops at Dusseldorf, Germany, Roughing a 60-ton Shaft. The Swing of the Lathe is 6 1/2 Feet, and the Length between Centers Over 75 Feet. The Total Length of the Bed is 95 Feet. A 350-horsepower Motor Makes it Possible to Cut at High Speed with Tools in All of the Three Tool-slides, Taking Chips with a Cross-section of 0.8 Square Inch Each. Work Weighing 120 Tons can be Machined in This Lathe. The Weight of the Machine is 165 Tons



It was in times like these. . .

IT was in times like these that Andrew Carnegie laid the foundation for what was to become one of the world's greatest industrial enterprises. It was in times like these that Thomas Edison, Alexander Graham Bell, Worcester Warner, and Ambrose Swasey prepared themselves for lives of outstanding usefulness and success.

It was in times like these that plans were made to harness the powers of Niagara out of which grew the world's greatest power development. And it was in such times that the first timid experiments were made with the "horseless vehicle" and ball bearings—experiments that were the beginning of an entirely new era, not only in transportation, but in the whole aspect of western civilization.

It is not in times of smooth sailing and opulent prosperity that men do their most constructive thinking. It is in times like these that ideas spring forth that revolutionize industry.

It is in times like these that men and enterprises can prepare themselves for the greater things that the future holds in store. At this very moment scientific discoveries are being made that will open up new avenues of industrial endeavor. The opportunities for men and for business that these new discoveries will create can only be vaguely imagined. The enterprises that will be built upon these discoveries will some day rival in size, importance, and usefulness the greatest of our present industrial enterprises.

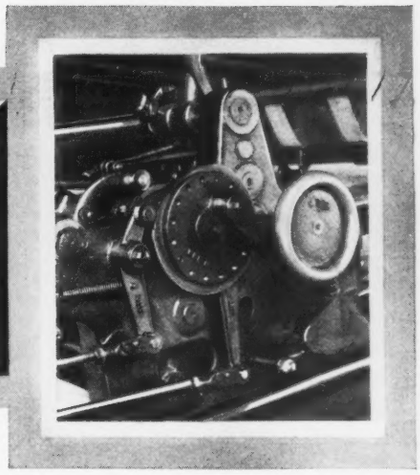
Way back in the 80's, when Charles Schwab completed a new rail mill for Andrew Carnegie, the farseeing vision and imagination of the great Scotchman for once failed him. Said he: "The country will never use all the rails you can roll in this mill, Charlie." Since that time the country has come to use, each year, a rail tonnage ten times as great as the rail mill capacity of those days.

Today timid men say: "The country will never again need all the productive capacity that we have." These men will not have to live very many years to see the present productive capacities inadequate to meet the demands of a reborn industrial era.

But these things will not just happen. They will come only as the result of courageous thinking and intelligent planning—as the result of a new industrial spirit that will make for cooperation in business and good will toward competitors, and of a new commonsense attitude in the relations of employer and employe.

The men who prepare themselves for their task with these ideas in mind, who plan their life and their business with this faith in the future, will reap their reward when the world recovers from the after effects of war, narrow nationalism, and outworn business policies.

Ingenious Mechanical Movements



Straight-Line Movement Applied to a Cam Follower

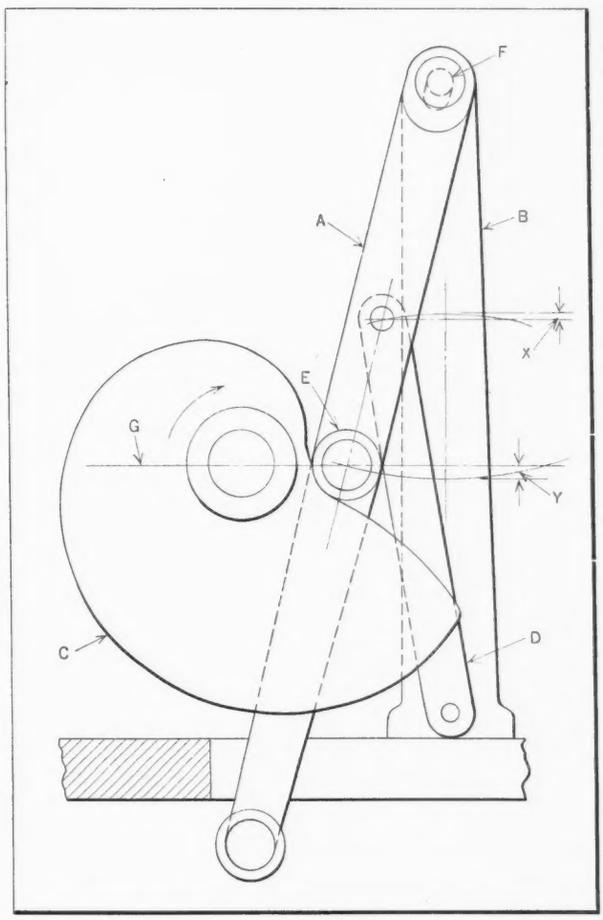
By WALTER A. SIMOND

A practical application of a straight-line movement obtained by means of a link and a lever is shown in the accompanying illustration. This movement is applied to the follower roll of a cam on an automatic machine intended for sawing slots in latch needles. It is similar in principle to the movement described in MACHINERY'S book "Ingenious Mechanisms for Designers and Inventors," on page 392.

The roll *E* moves 3 inches forward and backward, and the return movement is effected during one-twelfth of a revolution of cam *C*. Originally, the roll lever *A* was pivoted to the stationary bracket *B*, and was not equipped with the auxiliary link *D*. Consequently, the center of the roll *E* followed a curved path, and on the return of the lever *A*, the roll had a tendency to leave the cam surface, especially when the machine was operated at high speed. This action caused the roll to strike the low point of the cam with an appreciable impact during each cycle.

To overcome this condition, the pivot hole in the upper end of the lever *A* was elongated and the link *D* added to force the roll *E* to travel in a straight instead of a curved path. The center distance between the pivot *F* and the roll *E* is equal to that of the holes in the ends of the link. The lower end of the link is pivoted to the bracket, while its upper end is pivoted to the lever. This pivot is located in such a position that the distance *X* equals one-half of the distance *Y*.

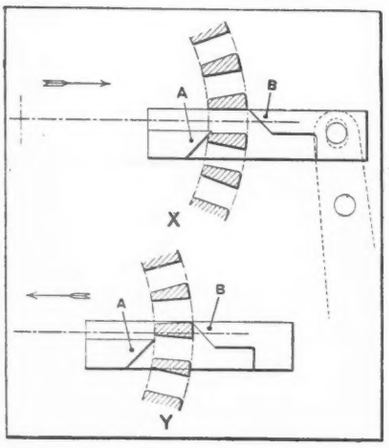
As the cam rotates from the position shown, the upper end of lever *A* is gradually lifted and lowered through the action of the link, so that the center of the roll *E* follows very closely the center line *G*. Thus, when the steep incline of the cam is reached, the roll is returned along the same straight line and remains in contact with the incline instead of leaving the cam surface, as when the roll followed a curved path.



Application of a Simple Straight-line Motion to the Follower Roll E

Simple Indexing Mechanism

A simple indexing mechanism consisting of a rotating ring having a number of radially milled slots and a sliding trigger piece is shown in the illustration (see next page). The device is operated by means of a hand-lever, which is indicated by dotted lines. At *X*, the finger *B* on the trigger



Simple Indexing Mechanism which is Operated Rapidly by One Lever

has just left a slot, and the inclined face of the finger *A* is engaging a corner of the same slot. As the trigger continues toward the right and the finger enters the slot, the ring is moved through a little more than half a division. The movement of the trigger is now reversed and the finger *B* engages the corner of the next slot, as seen at *Y*. As the trigger continues to slide toward the left, the finger *B* enters the slot and pushes the ring around to its correct indexing position. J. E. M.

Automatic Overload Release

By DAVID WILLIAMS

A machine for cutting coal in mining is subjected to such strains, jerks, and shocks that some overload protection is essential. A cast-iron safety washer which has been applied on mining machinery for over thirty years has certain disadvantages which have been overcome by the improved overload release to be described later. The safety washer is used in conjunction with a worm drive, as shown by the left-hand sketch in the accompanying illustration. This washer is placed over the worm and is held by a nut and a short section of pipe. The idea is to make this washer strong enough to hold the worm in place under normal loads. If the load is excessive, however, the thrust of the worm will break the washer, thus releasing the worm from its driving key.

The breaking of this washer made it necessary to drive the worm down on the shaft, replace the key, and insert a new washer before using the machine again. Although this cast-iron washer afforded simple and reliable protection, parts of a broken washer sometimes flew into the gearing or chains or were sometimes drawn by the motor fields and lodged against the armature, causing grounds and short circuits. Moreover, replacement required several months and there was no load adjustment.

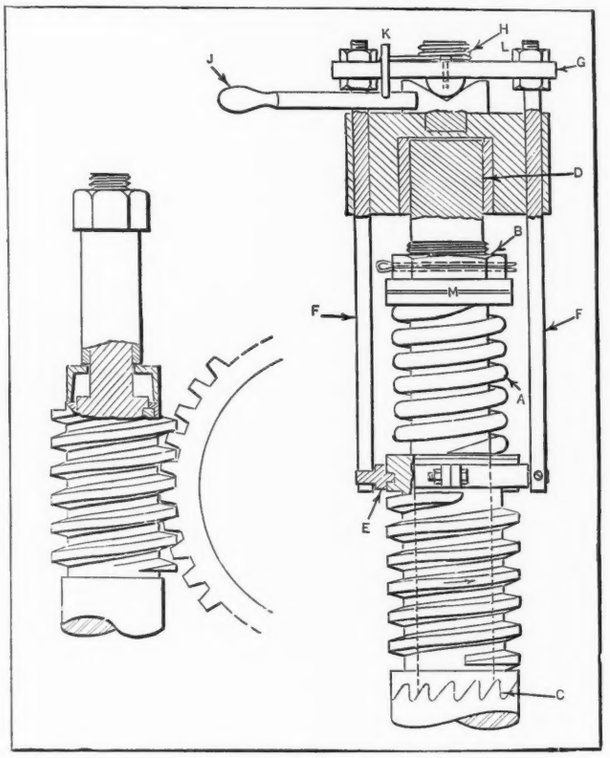
An overload release designed to eliminate the disadvantages of the safety washer is shown by the sketch at the right of the illustration. The worm is held in the running position by the coil spring *A*, the tension of which may be adjusted by nut *B* on the worm-shaft. A jaw clutch *C* is used instead of a driving key, and the extended worm-shaft has an outer bearing at *D*.

The action of the mechanism is as follows: During normal load, the parts are in the relative positions shown. If there is an overload, the worm thrust compresses spring *A* so that clutch *C* is disengaged. This axial movement of the worm is transmitted through ring *E* and rods *F* to plate *G*, causing the small coil spring at *H* to swing clutch handle *J* from position *K* to *L*, which locks the worm in the out or disengaged position. To reset, lever *J* is simply returned to its former place, which permits the driving and driven parts of clutch *C* to come into engagement.

It is important to have the ball thrust bearing *M* between spring *A* and nut *B*, because when the clutch is in the disengaged position, the worm-shaft and nut must necessarily continue to turn, while the worm is idle. The teeth of clutch *C* should be rounded at the edges to prevent damage at the moment of disengagement under load.

This mechanism is quick and positive, and can be applied to various other drives, especially when a machine is likely to encounter some obstruction due to careless adjustment or operation. It can be utilized to provide overload protection when a machine is running in one direction but not in the other. For example, many machines are geared for a higher speed during the return stroke, and overload protection is desirable for this reversal or backward movement. Various other applications will be apparent to designers.

It is obvious that every machine subject to overload should have its safety device, for the same reason that motors need fuses and circuit-breakers.



(Left) Cast-iron Safety Washer Release (Right) Improved Type of Overload Release

Mechanism for Guiding a Follower Along a Square Path

By R. H. KASPER

A mechanism for guiding a pointer along a square path is illustrated in Fig. 1. The rotating shaft *A*, through the action of cam *B* and dovetailed slides *C* and *D*, causes the pointer *E* to follow the square contour indicated by the dot-and-dash outline. The horizontal slide *D* is mounted in the stationary member *F*, which also serves as a bearing for the shaft *A*; and the vertical slide *C* is mounted in the slide *D*. Elongated holes are provided in both slides so that the slides will clear the shaft in operation.

Alternate vertical and horizontal movements of slide *C* are obtained through the action of the positive cam *B*, the lay-out of which is shown in Fig. 2. Here it will be seen that sections *PQ* and *RS* are concentric with the shaft *A*, and sections *RP* and *SQ* are drawn by scribing arcs having centers at *S* and *R*, respectively, to form the rises of the cam.

Referring again to Fig. 1, pointer *E*, attached to slide *C*, is in its lowest position and has just completed one half of the horizontal movement imparted by the cam *B*. As the cam continues to rotate in the direction of the arrow, slide *C* will move toward the left, carrying pointer *E* to position *G*. During the entire horizontal movement the concentric portions of the cam are in contact with the surfaces *K* and *H*, preventing slide *C* from moving vertically. However, when the pointer *E* reaches position *G* these concentric surfaces contact with surfaces *J* and *L* and prevent horizontal movement of slide *C*. In the meantime, the cam rises come in contact with the surfaces *K* and *H* and raise the slide *C* until the pointer reaches position *M*. These alternate vertical and horizontal movements guide the pointer *E* in its required path.

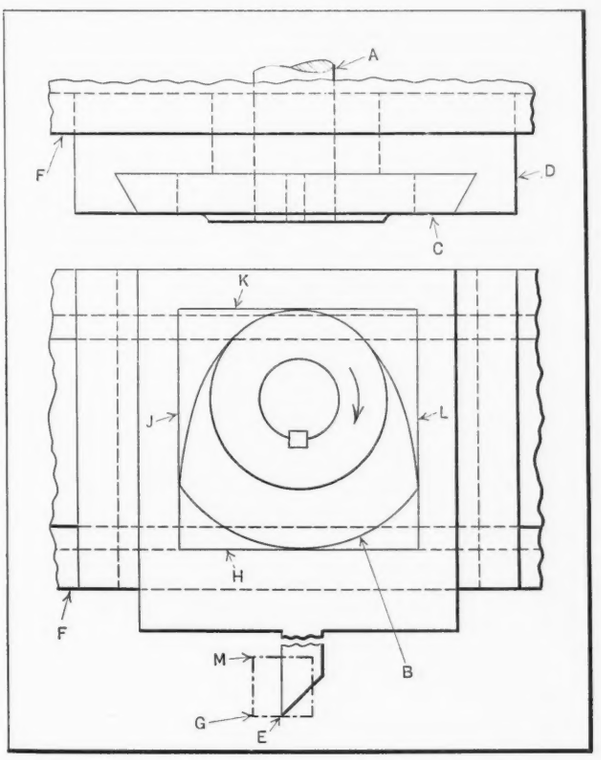


Fig. 1. Positive Cam Movement for Guiding Pointer E along Square Path Indicated by Dot-and-dash Lines

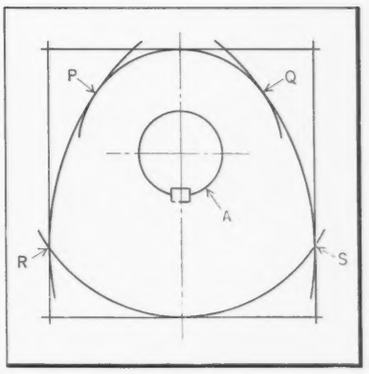


Fig. 2. Lay-out of Cam Used on Mechanism Shown in Fig. 1

* * *

Statistics of the Automobile Industry

The National Automobile Chamber of Commerce, 366 Madison Ave., New York City, has compiled the following statistics pertaining to the automobile industry in 1931: The total number of passenger cars produced in the United States and Canada was 2,045,000; the number of motor trucks, 420,000. The average retail price of the cars was $765; and of the trucks, $824. The total value of the products of the automobile industry, including accessories and service equipment, was $2,101,000,000.

During the year, 22,450,000 passenger cars and 3,490,000 trucks were registered in the United States. A total of 34,575,000 motor vehicles was registered in the entire world, so that approximately 75 per cent of the world's motor vehicles were registered in this country. Foreign sales amounted to 315,000 cars and trucks, while the number of motor vehicles imported during the year was 710. Over 4,000,000 people were employed in the motor vehicle and allied fields.

* * *

Course in Engineering Economics

The one-time conception of the engineer as one who gives direction only to the great sources of power has changed with the change of times and the evolution of the engineer. The modern role of the engineer now embraces also the economic and social aspects of engineering. In view of this broader scope of engineering, the University of Wisconsin Extension Division at Madison is offering a correspondence-study course in engineering economics, available for home study to students in any state.

This new course is intended as a first course on the subject. It will endeavor to provide engineers with a more comprehensive knowledge of this phase of economics through a presentation that is both brief and practical, and given from the engineering standpoint.

Special Tools and Devices for Railway Shops

Recommended by Railway Shop Superintendents and Foremen

Drilling Liner Holes in Driving-Wheel Hubs

The operation of drilling holes in driving-wheel hubs for attaching steel liners has been greatly facilitated in the Stratford, Ontario, shops of the Canadian National Railways through the use of the air-driven equipment illustrated. Eight of these liner holes are drilled equidistant around the hub. In the operation, previously drilled holes in the liners serve as guide bushings. The holes are 21/32 inch in diameter. They are drilled about 1 1/2 inches deep.

The unit shown in Fig. 2 is fastened on the driving axle of the wheel set by means of V-type strip clamps *A* and *B*. These are adjustable to suit axles from 7 to 11 inches in diameter. To position the unit for drilling the successive holes, it is only necessary to release handle *C* slightly, after which the equipment can be moved around the axle to the next position, and handle *C* reclamped.

The driving wheels rest on knurled rollers, and can be easily rotated so that the air-driven drilling device can always be used in approximately the position shown in Fig. 1. This equipment has proved very satisfactory, as it can be positioned and clamped speedily.

Power is delivered to the unit shown in Fig. 2 by means of an ordinary air drill, the driving socket of which is connected to one end of a shaft located at *D*. Mounted on the opposite end of this shaft is a spiral gear *E*, which drives spindle *G* through a second spiral gear *F*. Spindle *G* has a No. 2 Morse taper socket to receive the drill. As the spiral gears are of the same ratio, the spindle *G* is driven at the same speed as the air-drill spindle.

The drill is fed by turning handwheel *H*. Mounted on the same shaft as this handwheel is a worm *J* which meshes with worm-wheel *K*. On the worm-wheel shaft there is a small spur gear, the teeth of which engage rack teeth cut in spindle sleeve *L*. Thus by turning handwheel *H*, sleeve *L* and spindle *G* can be fed in or out as desired. The total spindle travel is 2 3/4 inches. O. H.

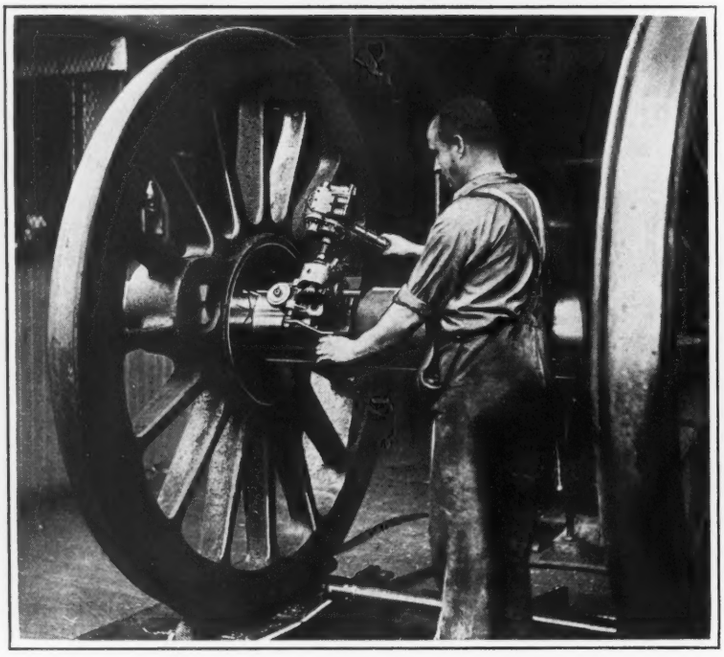


Fig. 1. Drilling Liner Holes in Driving-wheel Hubs with an Air-driven Device that is Easily Clamped in Different Positions on the Axle

* * *

Committee Will Study Ways of Developing New Machinery Business

The American Machinery and Tools Institute, 40 Wells St., Chicago, Ill., has appointed a committee to study ways and means of developing additional machinery and tool business within industries not directly associated with the machine industry. For example, many firms in the food, textile, building, printing, book-binding, paper, transportation, chemical, leather, and other industries need new machinery and tools to meet competition successfully. Many of these establishments are potential buyers.

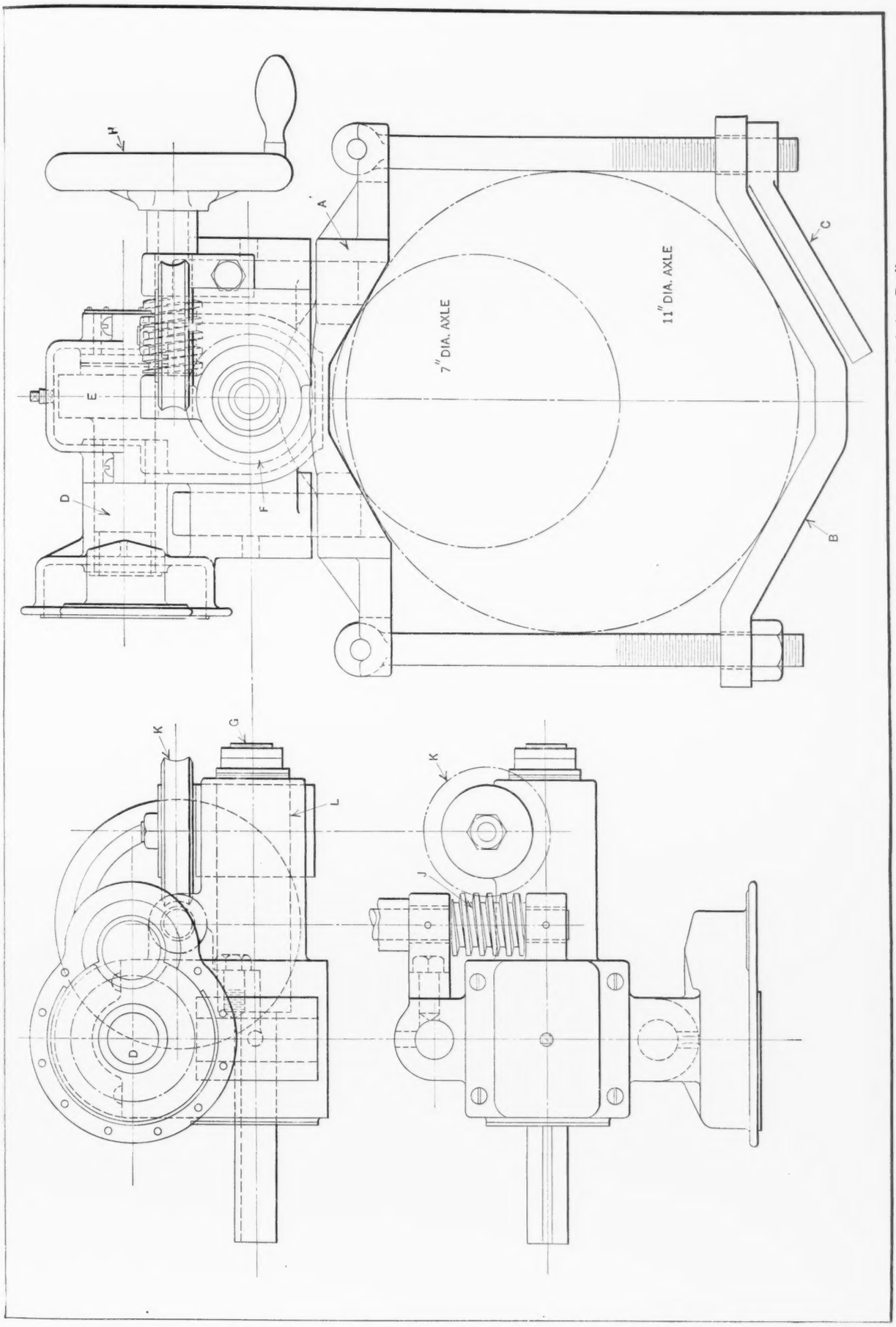


Fig. 2. Construction of the Liner-hole Drilling Equipment which Receives Power from a Standard Air Drill

Determining the Properties of Lubricating Oils and Greases

Tests to which Oils and Greases Should be Submitted to Insure Satisfactory Performance

By G. L. SUMNER, Oil Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

THE selection of lubricants requires a knowledge of the specific applications for which the lubricants are intended, as well as of available lubricants and means of testing them. It is advisable to have more than one supply company for each lubricant.

Approval of an oil should be given only after laboratory tests have been made on a sample, the physical characteristics of which are specified, and after a trial order of from five gallons to a barrel has been carefully observed in use in the shop. When the quality of a given oil has once been established, inspection tests should be made on successive shipments to see that the quality is maintained. Suppliers should not be permitted to make changes in an oil without first consulting the user. It has happened that the supplier, in attempting to make an improvement for the general trade, has caused trouble in a particular application for which the oil was purchased.

Tests that Check the Properties of Lubricating Oils

The tests made to judge the suitability of oils depend upon the kind of oil and upon the application for which it is intended. The tests should follow those specified by the American Society for Testing Materials in so far as possible, in order to keep on common ground with the suppliers. Tests used in judging the suitability of oils are as follows:

1. Color—by means of the Union colorimeter.
2. Specific gravity at 60 degrees F.—by means of a hydrometer or a gravity bottle.
3. Flash and fire point—by the open cup method, A. S. T. M. Specification D-92.
4. Viscosity at 100 and 210 degrees F.—by means of the Saybolt universal viscosimeter, A. S. T. M. Specification D-88.
5. Neutralization number—A.S.T.M. Specification D-125.
6. Steam emulsion (to determine the ability of the oil to separate from water)—A.S.T.M. Specification D-157.
7. Saponification number—A.S.T.M. Specification D-94.
8. Carbon residue (used mostly for internal-combustion engine oils)—according to A. S. T. M. Specification D-189.
9. Dirt or suspended matter—by centrifuging.
10. Pour (to determine fluidity at low temperatures)—according to A.S.T.M. Specification D-97.
11. Ash—to detect evidence of metallic soaps.
12. Sulphuric acid absorption (a check on the degree of refining)—by method 550.1, Bureau of Mines, Technical Paper, Bulletin 323.
13. Sulphur — by bomb method, A. S. T. M. Specification D-129.
14. Corrosion (on polished copper strips)—A. S. T. M. Specification D-130.
15. Precipitation number—A.S.T.M. Specification D-91—30T.
16. Service on trial order.

What are Grease Lubricants?

The term "grease" is applied to a mixture of mineral oil with fats that have been saponified with an alkali. To this mixture, fillers may or may not be added. Grease lubricant is available in three general classes known as hard grease, soft grease, and non-fluid oil. Suppliers usually classify greases as hard, medium-hard, medium, soft, and semi-fluid. It is difficult for a user to judge the consistency of greases from the gradings given because they are not standardized.

In comparison with oil, grease occupies a minor yet important place in the field of lubrication. It provides a solid lubricant for use where a fluid is not practicable, or at least not economical, as in certain types of vertical and horizontal motors having ball or roller bearings; in cases where the motor operates at an angle; in instances where the moving parts are so worn that oil will run away and be wasted; and in other places where oil will not "stay put." In shop maintenance, grease is particularly suitable for rough types of machines, such as cranes, mixers, etc., where the application by means of pressure cups gives a positive feed and reduces the man-hours required for supervising the lubrication of these machines.

Grease should have the proper consistency, the ability to resist heat in certain applications, should not turn rancid or permit separation of the oil from the soap while in storage or in service, and should have the ability to cling to bearings and not break down under violent churning. The amount and kind of soap used in preparing the grease, as well as the oil with which it is compounded, have, of course, a bearing on these requirements. Relatively higher melting points can be obtained through the use of a given amount of sodium soap, but, in contact with water, such a grease has a greater tendency to disintegrate than grease with a calcium-soap base. Obviously it is necessary to consider the application for which the grease is intended before condemning a particular grade.

Properties and Typical Applications of Some Standard Grease Lubricants

Grade	Properties and Applications
Rolling Mill Bag Grease	This is a grease containing 5 per cent sodium-base soap and 68 per cent mineral oil. It is used on the necks of hot rolls.
Roller Bearing Grease	This grease contains 5 per cent sodium-base soap and 94 per cent mineral oil. As its name implies, it is intended for roller bearings.
Roller Bearing Grease	This grease contains 10 per cent sodium-base soap and 89 per cent mineral oil. It has a melting point of 125 degrees C. It is used in the roller bearings of railway motors.
Ball Bearing Grease	This lubricant contains 14 per cent sodium-base soap and 85 per cent mineral oil. It has a melting point of 160 degrees C. This grease is intended for ball bearings and for use in phosphor-bronze rolling mills where high temperatures exist.
Motor Grease	This lubricant contains 18 per cent calcium-base soap and 82 per cent mineral oil. It has a melting point of 92 degrees C., and is intended for use in cups on cranes, motors, etc., and as a general-purpose grease.
Gear Lubricant	A black asphaltic hydrocarbon compound. It is used for herringbone gears and pinions in mills employed for the hot- and cold-rolling of copper.
Gear Lubricant	A dark heavy-bodied moisture-resistant material resembling grease, which adheres firmly to gear teeth and remains plastic under normal operating conditions. Used in copper rolling mills.
Gear Lubricant	A liquid compound containing no soap or fillers—apparently a blend of "gilsonite" asphaltum with mineral oil. Used for lubricating crane gears.
Gear Lubricant	A sticky black mineral hydrocarbon lubricant which requires heat for application to heavy-duty crane gears. It should be applied sparingly, as it might build up a coat that would crack the gear teeth.
Gear Lubricant	A black heavy-bodied hydrocarbon lubricant having a viscosity of 2000 seconds at 210 degrees F., as determined with a Saybolt universal viscosimeter. Used for lubricating railway motor gears.
Gear Lubricant	A black heavy-bodied hydrocarbon lubricant having a viscosity of 5000 seconds at 210 degrees F., as determined with a Saybolt universal viscosimeter. Primarily intended for crane gears.

The accompanying table lists some standard greases and their typical applications.

Testing Greases to Determine Their Properties

Grease analyses can be best made according to Specification D-128 of the American Society for Testing Materials. However, the analysis of grease is a difficult task and requires a high-grade chemist in order to obtain consistent results. The tests are expensive, and greases used for general purposes do not require a complete analysis. The following tests may be conducted to determine the suitability of grease lubricants for the applications for which they are intended:

1. Melting point — thermometer drop point method.
2. Soap—to determine the percentage and kind.
3. Evidence of separation—eight hours at 105 degrees C.
4. Evaporation percentage—eight hours at 105 degrees C.
5. Ash percentage.
6. Moisture—A. S. T. M. Specification D-95.
7. Mineral oil percentage.
8. Reaction—acidity or alkalinity.
9. Consistency, worked and unworked—according to A. S. T. M. Specification 217-27 T.
10. Effect of chilling.
11. Corrosion—on polished copper strips.
12. Service test.

An article, "Selecting the Right Lubricant," was published in January MACHINERY. A third article dealing with methods of supplying lubricants to bearings will appear in an early number.

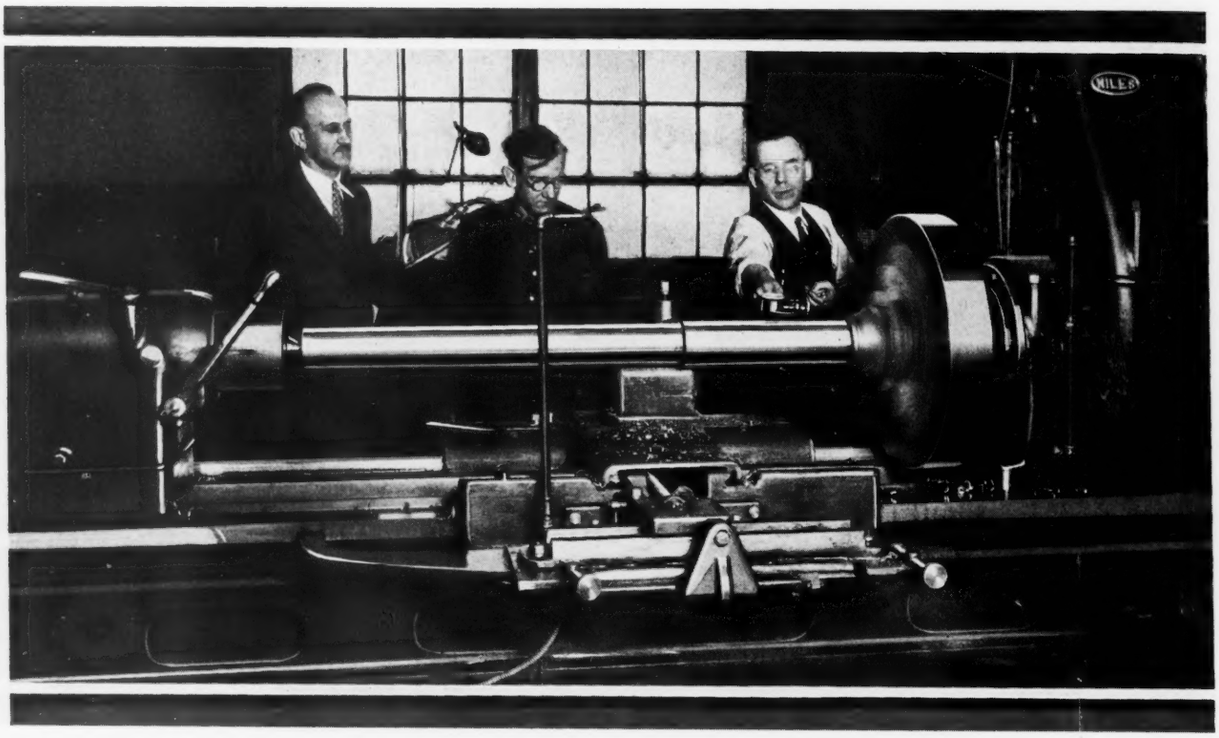
* * *

Outlook for the Electrical Industry

The electrical industry is in a peculiarly fortunate position, for even in the past year there has been an increased consumption of electricity in the homes, mainly because of the installation of a greater variety of electrical appliances. In that year also, industrial companies have modernized their productive methods, requiring new applications of electricity. The Pennsylvania Railroad has embarked on a great program of electrification, and this undoubtedly will be followed by others, where density of traffic, the convenience of the traveling public, and economic considerations show that a change to electric operation is advantageous. Because these things have been true in such a poor year as 1931, we look forward to 1932 and the succeeding years with confidence.—*Gerard Swope*, President, General Electric Co.

* * *

Prosperity is simply a matter of intelligence and good will. Our nation is able to produce with ease all it needs for maintaining a high standard of living. We have the materials, the machines, the money, and the men—what is it that we lack?



Testing and Recording the Performance of Small Tools

The Operation of a System that Enables the Purchasing Department of a Large Company to Save Thousands of Dollars Annually in Tool Costs

By C. E. GREENAWALT
Demonstrator, Manufacturing Equipment Department
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

COMPARING the records of practical tests as a guide in purchasing small tools is one of the most profitable methods that can be adopted by the purchasing department of a large company. Direct comparisons, point for point, between two or more competitive tools are highly desirable, but are difficult to make in many cases owing to differences in the basic designs and details of construction. Such differences may include weight, size, shape, construction, material, and various other elements on which direct comparisons are generally made.

However, if comparative tests are carefully planned and carried out, a close analysis of the results will usually yield the desired information. The comments of the men in the shop serve as a positive check on the conclusions drawn from the tests, and the choice of tools is guided to a considerable extent by the preference of the workmen. Unless the operators are "sold," there are always likely to be complaints on the quality of tools.

The test period for a tool, before it is accepted for regular use in the shops of the Westinghouse Electric & Mfg. Co., may be several days or it may be as long as from six to twelve months when the test is to determine the useful life of the tool under actual working conditions.

The first appearance of a new tool in the purchasing department

CHARLES EMERSON GREENAWALT, demonstrator on drilling equipment at the Westinghouse Electric & Mfg. Co.'s plant, East Pittsburgh, Pa., was born in Wilkinsburg, Pa., in 1905. After graduating from high school, he attended the Carnegie Institute of Technology. He was first employed by the Westinghouse Electric & Mfg. Co. in the manufacture of network circuit-breakers. Later he was engaged in the initial developments of the automatic arc welder. His present occupation includes the set-up of drilling equipment and instruction of operators; comparison tests on drills and special tool steels; and the making of machine tool surveys.

occurs when it is presented for approval by a representative of the manufacturer or when it is submitted directly by the maker. A careful examination of the sample is made by the supervisor of small tools and supplies, who has had a wide and varied experience in this work. The small tool buyer, who is chiefly interested in the quality, cost, and delivery dates of the product, also joins in this examination.

If the tool appears to have any qualities that are superior to the equipment in use, it is immediately submitted to the test division of the manufacturing equipment department, where actual tests are begun. This division uses the entire shop for its laboratory and research work. Here many tools are placed in active use on production jobs, and a study of operating costs and the quality of the product is made. Various tools that cannot be tested in this manner are given to the chemical, physical, or research laboratories for analysis, while other tests are conducted personally by the demonstration division, which is also a branch of the manufacturing equipment department. The test division serves as a center from which all tool tests are distributed throughout the plant and from which individual observations are made during the test period.

WESTINGHOUSE ELECTRIC & MFG. COMPANY

DRILL TEST CHART #5031

Test Number 3000 Date 9-3-30
Type of Drill Standard Twist Size 9/16
Brand Tungsten Carbide Supplier Witheld
Style of Shank Vee Req. No. Sample
Submitted to A. Hauser Tool Supervisor Date 7-6-30
Submitted to R. Schlenke Demonstrator Date 7-7-30

Details of Test

Type of Machine 4 Spindle Machine No. 38147 HP 2 Dept. F-13

Make of Drill	Material Drilled	RPM	Feed per rev.	Feed per min.	Cutting speed FPM	Number of Holes	Thick. of Mat.	Total in. Drilled	Condition of drill.
"A"	Ebony	1796	Hand	24.09	2644	4110	1"	4110	Regrind
Tungs.C.	Asbestos	(Average No. Holes Per Grind)						1370	3 Times
"B"	Ebony	1080	Hand	15.5	150	351	1"	351	Regrind
H.Spud	Asbestos	(Average No. Holes Per Grind)						117	3 Times

Drilling Lubricant None

Remarks During this test no attempt was made to record the horsepower used, torque, drilling time, and similar information. The comparison shown above was all the data required.

Date Test Completed 8-22-30 By R. Schlenke
Test Approved J. M. Highducheck Mfg.Equip.Dept. Date 8-24-30
Test Approved F. S. Walters Supv.Small Tools Date 9-5-30

Fig. 1. Typical Drill Test Chart

Methods of Recording Test Data

A test number is assigned to each tool at the beginning of its test or travel through the works, and all data and correspondence relative to the tool are given a similar number. This eliminates any chance of reports on different tools becoming exchanged or mixed. A large chart known as the "Progress Report for Incomplete Small Tool Tests and Investigations" is maintained by the test division. This chart contains a record of the location and status of incomplete tests at all times. In addition, it carries a completion date for each test. Upon being received from the purchasing department, the tools to be tested are segregated into 15-, 30-, 60-day and life test groups. Past experiences with standard tests enable a fairly close time limit to be established for each test. If at the end of the 15-, 30-, and 60-day periods the reports are not submitted, a "Delayed Progress Report" blank is sent to the department making the test, requesting the reason for the delay.

All data from the various departments that have completed their tests are forwarded immediately to the test division. Detailed reports are then compiled and entered in one final report, including proper recommendations, and returned to the purchasing department where, if satisfactory, the tool is adopted as standard and purchased.

Forms for Recording Test Data

In order to give the supervisors and workmen all the assistance possible and to help the test division in securing every detail of information necessary for the final report, a series of charts was constructed. In Fig. 1 is shown a typical Drill Test Report, and in Fig. 2 is illustrated a report on a pneumatic chisel. A report on a tap is shown in Fig. 3. The purpose of these charts is to assist in obtaining a clear and concise report from the shop and to lessen correspondence in handling the tests. A copy of the chart accompanies the tool in each case, and is returned when it is filled out completely.

Other charts (not shown, but of similar arrangement) are provided for metal stamping dies, wire wheels, abrasive belts, abrasive cloth, abrasive disks, band saws, electric and pneumatic portable tools, files, milling cutters, paint spray guns, power hacksaws, vises, hand hacksaw blades, etc. This cycle of test work keeps the shop informed on the construction and cost of the most modern and use-

ful tools. Were it not for the test division, the plant would be stocked with an abundance of obsolete tools and equipment.

Many economies result from the small tool tests, which are divided into two groups—commercial and production. Commercial savings are based on two fundamental points: First, there is the reduction in cost resulting from the selection of a lower priced tool without lowering the standard of quality; and second, there is the selection of new tools of an equal or higher cost but of superior quality, which enables the user to obtain an increased ratio of performance.

Production savings are based exclusively on various jobs where increased production is gained per unit. If a close record is kept of the individual costs of each test and the resultant savings, the difference will represent the true value of this endeavor. However, there are a number of investigations where the product submitted does not show any merit over the present equipment in use. In these cases, the cost of the tests may be absorbed by the more profitable ones. The latter tests are in the minority; that is, the majority of the tests produce no profitable results, but notwithstanding this fact, it has been proved that over an extensive period of time, the saving resulting from the lesser number of productive tests is much higher than the total cost of the majority. It is, therefore, evident that this cycle of progress in the introduction of better tools furnishes many improvements and reductions in operations and costs.

WESTINGHOUSE ELECTRIC & MFG. CO.
EAST PITTSBURGH
MANUFACTURING EQUIPMENT DEPT.

PNEUMATIC CHISEL TEST CHART 5154

Test Number 236 Date 11-26-30
Brand of Steel Witheld Cost ?
Supplier Witheld Cost of 11" Chisel Blank ?
Forge (1700°-1900° F) not below 1500° F
Anneal (1425°-1450° F)
Harden (1650°-1800° F) Quench in oil (1550°-1600° F in water)
Draw (400°-500° F)

CHEMICAL COMPOSITION OF CHISEL

C	Mn.	P.	S.	Si.	Ni.	Cr.	Va.	W.	Co.	M.
.42	.25	.02	.02	.25	0	1.25	.20	2.00	0	0

Type of Chisel, Flat pneumatic, 3/4" octagon, 11" long, cutting edge 7/8" wide, ground to 130° included angle. (W-5 Sketch 227-A).
Rockwell C Hardness Chisel #1 57 #2 55 #3 55
Pneumatic Hammer used Sige B Thor Air Pressure 80 Lbs.
Test Blocks: Chemical Composition C . .48, Mn. .66, P . 1.01, S . .045, Ni. 1.51, and Cr. .59. (W-5 Sketch 1-B-211)
Brinell Hardness: Block #1 - 277
#2 - 293
#3 - 311
#4 - 331
#5 - 342

Conditions: In this test three chisels are used. Each chisel is tested on the five blocks. The chisels are each ground five times once after each test. The test consists in removing a section of metal 1" long by 13/16" wide by 1/8" thick from each of the test blocks. The selected value which is the basis of comparison is the mean time taken by each chisel.

	DETAILS OF TIME TAKEN						SELECTED VALUE
	Chisel #1		Chisel #2		Chisel #3		Average
Block	Min.	Condition	Min.	Condition	Min.	Condition	Time Taken
1.	.875	Good	.900	Fair	1.310	Fair	by each chisel
2.	1.750	Fair	2.000	Fair	1.580	Fair	
3.	.933	Good	.880	Good	1.172	Fair	#1 1.316 min.
4.	1.410	Fair	1.379	Fair	1.310	Fair	#2 1.240 min.
5.	1.615	Fair	1.042	Fair	1.359	Fair	#3 1.346 min.
Total	6.583		6.210		6.731		3.902
Average	1.316	Average	1.240	Average	1.346	Avg./chisel	1.300 min.

Operator Al. Palesmini Observer C. Greenawalt Date 11-20-30
Approved J. M. Kirkpatrick Mfg. Equip. Dept. Date 11-22-30
Test approved C. A. Walters Supv. Small Tools Date 11-28-30

Fig. 2. Chart with Test Data on Pneumatic Chisel

* * *

Improved Sales Methods for Industrial Supplies

By IRA O. HOFFMAN

A movement recently inaugurated by the manufacturers and distributors of industrial and mill supplies aims at more economical selling. It corresponds to similar efforts in other branches of industry, all designed to reduce distributing costs.

Sales of mill supplies in the United States are estimated at $1,000,000,000 a year. The buyers are chiefly mills, factories, mines, government departments, schools, railroads, and contractors using machinery, tools, and general supplies. A manufacturer may be a producer and a seller of mill supplies, such as steel shapes, and a buyer and a user of other supplies. These goods are distributed mostly through supply houses. Some large corporations maintain their own sales organizations to cover the country.

This great market has been disturbed by selling practices that the trade considers unreasonably costly. At the convention of the American Supply and Machinery Manufacturers' Association in 1929, a merchandising committee was appointed to survey the market and report a policy of economical selling. The National Supply and Machinery Distributors' Association and the Southern Supply and Machinery Distributors' Association joined in the movement and met in joint convention with the manufacturers in 1930 and 1931. The Joint Merchandising Committee, representing both manufacturers and distributors, recommended that manufacturers aid distributors by protecting them in their selling fields, and that both parties make satisfactory selling agreements which will bring about cooperation for the benefit of manufacturers, distributors, and users.

The 1931 convention voted unanimously that the committee put its recommendation into practice. An office has been opened at 704 Mahoning Bank Building, Youngstown, Ohio, with R. M. Gattshall as executive manager. This office is working with manufacturers and distributors for the adoption of the cooperative plan.

The committee advises the trade that successful cooperation rests on a few basic points. By agreement, the manufacturer and the distributor can set up satisfactory financial terms. The manufacturer will find it advantageous to advertise his goods, to send a factory expert to train the distributor's salesmen in selling the line, to aid the distributor in servicing the goods for customers, and to refrain from selling direct in the distributor's field.

The distributor may increase sales and establish permanent trade by handling fewer lines of competing goods, by specializing in what he sells, by selling at a profit for the manufacturer and himself, and by giving customers prompt delivery and service.

* * *

Men are More Important than Machines

It seems to me that the very real achievements of science and engineering fail of their effect because the human side of the world's problems has been neglected. We have been absorbed in things. We have neglected to notice the effect of men absorbed in things on other men absorbed in things. We have been proud, for instance, of what engineering has done to annihilate space. Transportation, telegraph, telephone, and the press bring men from the ends of the earth into a new and closer relationship with each other. But we have done practically nothing to develop a technique of human relations to meet the new problems brought about by those closer relationships. Almost every step forward in science and engineering has produced similar new contacts and a whole series of concomitant problems and miseries.

The wonderful qualities of insight, patience, indeed the genius that has been applied to the material accomplishments of modern times, must now be turned to a much more difficult job. The results of these discoveries must be turned to a more worthwhile, a more comprehensive use. Scientists and engineers (and all of the rest of us for that matter) must now concentrate on the study of the relations of man to man, of group to group and of nation to nation.—*Robert D. Kohn*, President, The American Institute of Architects, in *Research Narratives*

* * *

Taxes can be levied either so that they will stimulate business or so that they will stifle and hamper industry and trade. Most of the taxes proposed at present are in the latter category. Unfortunately, taxation principles are not generally understood.

WESTINGHOUSE ELECTRIC & MFG. CO.
EAST PITTSBURGH, PA.
MANUFACTURING EQUIPMENT DEPARTMENT

TAP TEST CHART #5191

Test Number 416 Date 4-20-31
Manufacturer Withheld
Type of Tap Machine Tap Size 1/4-20 N.C.
Kind of Material in Tap High Speed Steel
Number of Flutes in Tap 2 Req.# Sample
Submitted to A. Hauser Tool Supv. Date 4-1-31
Submitted to Wm. Connor Demonstrator Date 4-2-31
Test conducted in Motor Apparatus Department Section F-12
Tap charged to J. L. Brown Ch. # 65
Remarks on Specifications General specifications of the tap passed by the inspector

CONDITION OF TEST

Type of machine Special Tapping Machine
Machine Number 16436 Col.# 15 Speed, FPM 25 RPM 382
Kind of material tapped Cold Rolled Steel
Dwg. No. 8368 Item #2 Cutting Lubricant Lard Oil
Method of Holding tap Floating Chuck
Kind of tapping, Blind or Through Blind Size Hole #7 Drill
Depth of holes 1/2 inch Number of taps used One
Total No. of holes tapped 1277
Av. No. holes tapped per tap (1277 H.S.) (300 Carbon)
Remarks, Condition of the tap or taps, (State whether taps were broken, twisted, or required grinding) Requiried Grinding. The performance of this tap was compared with a 1/4-20 N.C. Carbon tap. Under similar conditions the carbon tap, tapped 300 holes before it was reground. The object of this test
Recommendations was only to determine the number of holes that could be tapped with a H.S. tap. Use H.S. taps for this application. These taps have over four times the life of carbon taps.
Completed 4-18-31 By Wm. Connor, O'Brewer
Approved by J. M. Highducheck Mfg. Equip. Dept. Date 4-19-31
Test approved F. S. Walters Supv. Small Tools Date 4-22-31

Fig. 3. Results of Test Conducted with Tap

Stellite-Tipped Twist Drills

In a paper read at the University of Detroit, by C. C. Pendrell of the Haynes Stellite Co., reference was made to a series of tests now being conducted with Stellite-tipped twist drills. It appears that there is a definite field for this application of Stellite. The drills are made by butt-welding solid Stellite tips to carbon steel shanks. The flutes of the steel shanks are Stellited the full length. So far, it appears that a 15-degree spiral is the most satisfactory to use. This degree of spiral makes it possible to employ a tip of a comparatively heavy section and great strength.

* * *

Gasoline-propelled railway cars, equipped with rubber tires, have been constructed in France. These cars are intended for high-speed service, and are said to have given excellent results in recent tests. They are built extremely light and designed with a view to reducing wind resistance. The effects of the rail joints on vibration are said to be practically eliminated, and the cars run very smoothly.

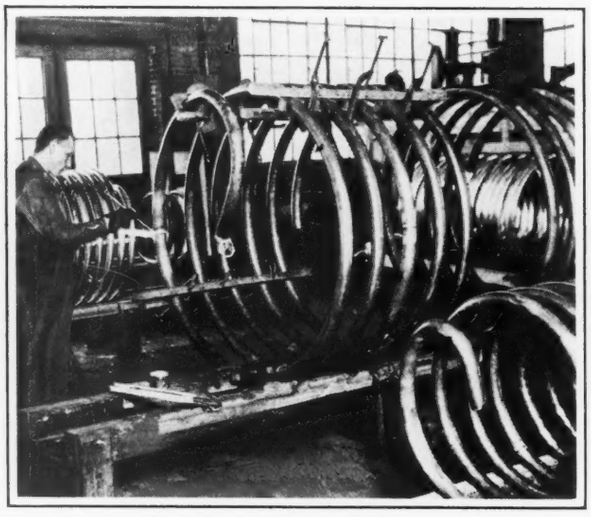
Brazing Metals with Silver Solders

Kinds of Fluxes and Temperatures Required for Brazing Operations—Second of Two Articles

By A. EYLES

THE composition and physical properties of silver solders used for joining metal parts by brazing were described in a previous article, published in January MACHINERY, page 348. The present article deals with such factors as the preparation of the surfaces to be joined, the kind of fluxes to use, and the brazing operation.

Generally, the principal object in using silver-brazing is to obtain a sound joint possessing strength and the power to withstand bending stresses, shock, and vibration. Hence, too much care cannot be taken in preparing the metal surfaces to be joined. Although the flux will dissolve films of oxide during the brazing operation, it is necessary to start with clean surfaces. Metal that is clean is much more likely to make a strong sound joint than when impurities are present. Various methods of cleaning are in use, such as filing, scraping, grinding, machining, etc. If the metal parts are greasy, they should be put into a hot alkali cleaning solution to remove all grease or oil.



One of the Many Applications for which Silver Solders are Suitable—Brazing the Joints of Large Copper Coils

The joints should be smooth, and they should fit closely. The parts should be held together firmly while the brazing operation is being performed. Silver solder is remarkably fluid when in a molten state and penetrates interstices that ordinary brazing spelter would fail to fill. Only a film of silver solder is needed usually to give a sound joint, and it is not advisable to use this material as a filler.

Fluxes for Silver-Brazing

In order to protect the metal or metals against oxidation and to increase the free flowing properties of the silver solder, it is essential that the proper flux be employed. The best and most reliable flux for silver-brazed joints is borax. As the commercial powdered borax contains approximately 47 per cent water of crystallization, which causes a bubbling action during the heating operation, it is much better to have it calcined (fused). Calcined borax takes up this water of crystallization rapidly, and hence, it is inadvisable to use water when it is desired to make a solution or paste of the calcined borax. There are many special fluxes that contain borax, boracic acid, phosphoric acid, and other chemicals. A saturated solution of sodium cyanide or potassium cyanide with a small percentage of borax or boracic acid is convenient for small work, but experience shows that this has not the fluxing properties of borax. For ordinary purposes, borax or a combination of borax and boracic acid will meet all requirements. The fluidity of the flux has an important bearing on the brazing operation. The relative fluidity of borax, boracic acid, and combinations of these salts at different temperatures is given in the accompanying table.

No sharp thermal effects are observed in the fluxes, but there is a decided change in the consistency of the flux with the temperatures given in the table. Tests have shown that boracic acid must be heated to 1600 degrees F. before it becomes as fluid as borax does at 1400 degrees F. As it requires a temperature of approximately 1400 degrees F. to bring borax to a thin liquid state, this material serves as a good temperature indicator during the brazing operation.

Although powdered borax can be used in many forms, it is generally most satisfactory when applied in the following ways: (1) Dissolve borax in hot water, making a saturated solution, and apply while hot to obtain an evenly deposited coat. (2) Mix powdered borax and clean water to make a fairly thick paste. (3) Mix fused borax with alcohol. This flux must be kept in a closed container when not in use, in order to prevent evaporation. Stainless steels or alloys containing an appreciable amount of chromium require special fluxes.

A flux composed of equal parts of borax and boracic acid made into a paste with a saturated zinc chloride solution is much better than borax alone for brazing stainless steels. This flux can also be made by using zinc chloride crystals, fused borax, and boracic acid, which should be thoroughly mixed

and ground together. If it is desirable to use the latter composition in paste form, it will be necessary to employ alcohol because the addition of water tends to cause caking of the fused borax.

Temperature for Brazing with Silver Solder

All brazing, welding, and soldering operations require the proper amount of heat in order to obtain a first-class job. The temperature required varies with different metals, irrespective of the solder used. In brazing with silver solders, it is important to remember that not only must the proper temperature be employed, but the required amount of heat must also be supplied. The metals to be brazed with silver solder should be pre-heated at the joint and adjacent areas. This can probably be best accomplished by the use of a torch flame.

If expertly manipulated, an oxy-acetylene torch can be used successfully in making silver brazed joints. The flame is intense, however, and must be kept in constant motion. For delicate products or components, an oxygen-and-gas or a gas-and-air torch will give good results. In actual brazing operations, care should be taken not to overheat the work. When the work has been sufficiently preheated, the flame should be moved away and the silver solder brought to the point where the joint is to be made. If the parts have been properly fluxed and preheated, the silver solder will melt and flow into place quickly.

Temperatures at which Fluxes Change Their Consistencies

Composition of Flux		Begins to Thicken, Degrees F.	Becomes Decidedly Viscous, Degrees F.	Becomes Extremely Viscous, Degrees F.	Becomes Almost Solid, Degrees F.	Becomes Solid, Degrees F.
Borax, Per Cent	Boracic Acid, Per Cent					
100	...	1400	1330	....	1165	1125
75	25	1490	1440	1300	1240	1120
50	50	1510	1460	1325	1250	1160
25	75	1510	1470	1325	1220	1140
...	100	1600	1510	1280	1160	1050

The knack of heating the work to the proper temperature can be developed readily with a little practice. The principal metals on which silver solders are used for brazing begin to melt at approximately the following temperatures:

Steel	2500 degrees F.
Monel Metal	2480 degrees F.
Copper	1985 degrees F.
Nickel Silver	1945 degrees F.
Bronze	1830 degrees F.
Brass, Hard	1620 degrees F.
Brass, Soft	1480 degrees F.
Silver	1650 degrees F.

It is essential that the parts to be brazed with silver solder never approach the temperatures given in this tabulation, as prolonged heating at such high temperatures tends to give the metals coarse grain and poor structure. For instance, Monel metal should not be heated above 1450 degrees F., although it melts at a much higher temperature, and it is advisable to select silver solders that melt at temperatures not above 1400 degrees F. If this precaution is observed, there will be less danger of the work becoming distorted.

Brazing Stainless Steel

Recent experiments have shown that stainless steels and irons can be brazed satisfactorily with silver solder. The surfaces must be properly cleaned and fluxed to prevent the forming of an oxide film. When this is done, strong lap or scarf joints are readily obtained, provided the temperature of the stainless steel itself is raised to about 1575 degrees F. when using silver solder that flows freely at about 1440 degrees F. Silver solders containing 10 per cent silver and having a relatively high zinc content give better results than solders containing over 50 per cent silver.

By the addition of small percentages of nickel, it is possible to produce a silver solder that contains between 40 and 50 per cent silver and that flows readily below 1450 degrees F. This solder is of a white color and makes strong joints. The heating should be continued only long enough to cause the solder to flow freely. Prolonged heating must be avoided, as it tends to oxidize and weaken the silver brazed joint and the adjacent metal.

As soon as the joint is completed, the brazed product or parts should be plunged into cold water, if their size permits. This causes the flux to disintegrate quickly, whereas if the brazed joint is allowed to cool slowly, the flux usually forms a vitreous film on the work. It is difficult to remove this film, even by filing or scraping. A little sulphuric acid added to the water used for quenching assists in removing it. If necessary, the silver brazed joints may be cleaned by filing, grinding, or polishing. While silver-brazing requires skill, it is not difficult to accomplish if proper attention is given to the heating of the joint and the right flux is used. For instance, one large manufacturing concern building high-class automobiles employs girls for silver-brazing copper oil-lines for the engines.

Emergency repairs to machine parts of various kinds can often be made satisfactorily by brazing with silver solder. It is essential, however, that the proper brazing alloy and flux be used. In one case, repairs to a 1440-horsepower, 2300-volt synchronous motor, operated at a speed of 514 revolutions per minute, necessitated securing a large number of copper bars to retainer rings. Many kinds of brazing spelters and solders were tried for brazing the copper cross bars to the hard drawn copper retainer rings without success. Finally, a silver solder that permitted the job to be done quickly and satisfactorily was obtained. This solder, known as "Handy" silver solder, was obtained from Handy & Harman, New York. Since this experience, silver-brazing has been adopted as standard practice for similar jobs throughout that plant.

Are Short-Center Flat-Belt Drives Practicable?

By W. D. HAMERSTADT
Vice-President and General Manager
The Rockwood Mfg. Co., Indianapolis, Ind.

ENGINEERS throughout industry frequently ask the question "Are short-center flat-belt drives really practicable?" Such questions are the result of certain erroneous impressions that have been handed down by the pioneers in belt engineering.

For instance, Dr. Frederick W. Taylor concluded that a satisfactory belt drive was one having a center-to-center distance between the pulley shafts of from 20 to 25 feet. His experience was based on pulleys with fixed centers. More or less uniform tension is obtained in belts of that length because the weight of the belt itself overcomes the effects of elongation due to stretch. In shorter belt drives with fixed pulley centers, the tension will vary with atmospheric changes and differences in the load. As a matter of fact, the length should not be a factor in designing a belt drive. The important point is to provide a means of maintaining the proper tension.

For a long time, designers refrained from using short-center flat-belt drives, because they had been taught that such drives were impractical. The first extensive application came with the adoption of a belt for driving the fan of automobiles from the crankshaft.

The experience of the Rockwood Mfg. Co. in observing hundreds of short-center flat-belt drives has been that such drives are practical and highly efficient, if proper tension can be maintained; that is the only variable which need be considered. The proper tension can be maintained by mounting the motor on a base fulcrumed in such a way that the combined weight of the motor and base acts on the belt. An adjustment should then be available for moving the motor along the base to obtain the proper lever arm with respect to the actual load, although, generally speaking, the base can be so designed that the motor used for the drive will produce the desired tension in the belt without much adjustment.

In such a drive, the initial tension is constantly maintained, and there is automatic compensation for expansion and contraction in the belt, due to atmospheric changes, centrifugal force, or other conditions. With other types of drives that permit the tension to lessen, the belt will soon slip, or if the initial tension is made high enough to insure that the belt will perform for a long period of time without slipping, the belt will be unduly strained and the bearings will be subjected to excessive pressures. This is likely to cause undue wear of the bearings.

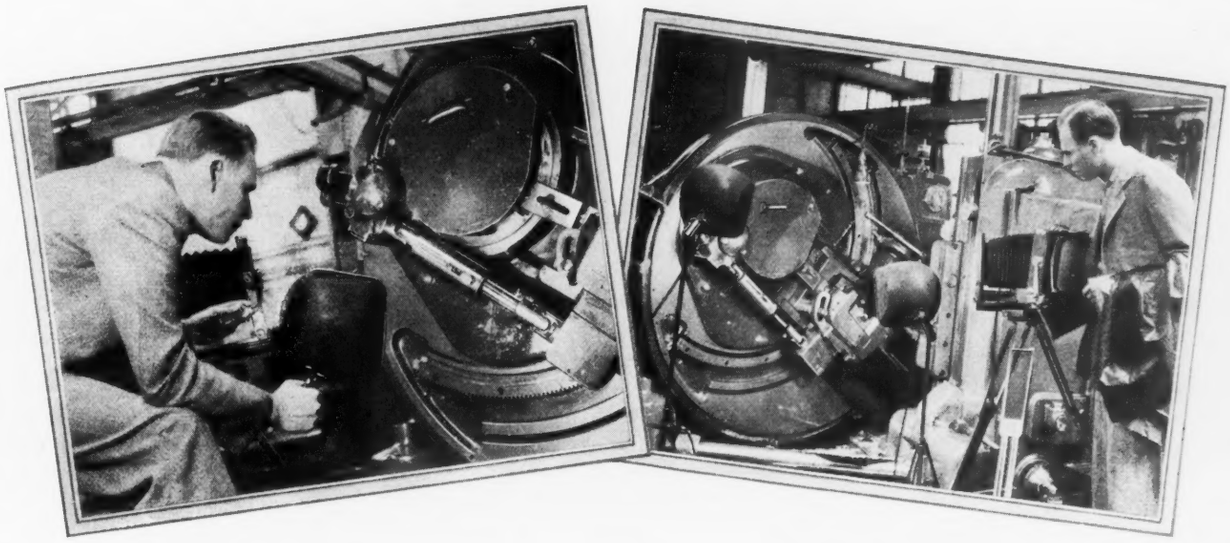
The important point to remember in designing flat-belt drives is that all the disadvantages, such as slip and failure to transmit dependably, are traceable to varying tension. Keep the tension uniform and the disadvantages will be eliminated. When a proper and uniform tension has been applied to belts that previously failed within a brief period, the belts have lasted very satisfactorily. In some of these drives, the belts have lasted from six to seven years, and are still in good condition. A maximum tension of 300 pounds per square inch is recommended by the Rockwood Mfg. Co. for flat belts. If the tension is correct, flat belts can be run with efficiencies of 95 per cent and higher. Another important advantage with flat belts is that, because they perform efficiently at high speeds of from 4000 to 4500 feet per minute, the effective pull and bearing pressure can be comparatively low.

Short-center flat-belt drives equipped with means of maintaining a constant tension are especially suitable for installations having sudden peak loads. A case in point is the drive for an air compressor or a bulldozer.

Not enough thought is given to proper belt usage. Too big a belt running at too slow a speed is commonly employed, because users have been in the habit of thinking in terms of belt size rather than of belt tension. Increased belt life and more efficient performance will be assured if the proper tension is maintained uniformly.

* * *

The effect of a water jet impinging upon metal has been demonstrated at the Westinghouse Research Laboratories at East Pittsburgh, Pa. In order to investigate the corrosion-resisting qualities of different metals, blades of the metal to be tested are inserted in a disk revolving at a speed of 20,000 revolutions per minute, which is equivalent to a peripheral speed of about 13 1/2 miles a minute. At this speed, a tiny jet of water from the city supply is impinged against the blade. The steel may be said to be gnawed away about as swiftly as a mouse would eat cheese. Samples of stainless iron and nickel steel are cut nearly in half in three or four minutes; Stellite, famous for its hardness, under the same tests, lasts ten minutes; while iron nitride, almost diamond-hard, holds out for from fifteen to twenty minutes. This test subjects the metal in a very concentrated form to the same effects as turbine blading is subjected to gradually from moisture in steam.



Better Machine Shop Photographs

By WILLIAM E. BARR

An Understanding of a Few Fundamental Principles of Machine Photography Aids the Shop Manager to Cooperate with the Photographer—First of Three Articles

A GLANCE through a few industrial magazines is all that is needed to convince one that many machinery photographs are not so good as they might be. They are inferior on either one of two counts, often on both: (1) poor photographic quality; or (2) incorrect delineation of important features, due to faulty angle of view or to incorrect lighting of subject.

At the present time, considerable interest is being taken in improving machinery photographs and industrial photographs in general. Shop managers and engineers frequently say that they are unable to get satisfactory results from their photographers; many photographers, in turn, object to having machinery pictures, good in photographic quality, rejected because they fail to show some point that seems insignificant to the photographer but is, perhaps, all-important from an engineering point of view.

At this point it is fitting to quote a statement by Richard B. Willcock writing in the British *Journal of Photography*: "Success in machine photography is to be attained only by the operator's ability to combine faultless photography with correct interpretation of the exact instructions laid down by the engineer. It will also add to the photographer's efficiency if he be able to apply to his task a knowledge of the fundamental principles governing the type of work with which he is dealing and attempting to picture by photography."

These statements are certainly true, with one reservation: A successful job of machinery photography should not rest altogether on the shoulders of the man behind the camera. The degree of his knowledge of his own craft largely determines the quality of the result, but the shop manager must cooperate in every possible way.

How can he cooperate? It is the purpose of these articles to answer that question. Generally speaking, the ability of the shop manager to assist the photographer to get the results wanted depends upon the manager's knowledge of a few fundamental principles of machine photography—what the photographer can be expected to do and what he cannot be expected to do.

Every man in the mechanical field who uses photographs should acquire as much photographic knowledge as he can, to enable him to understand the possibilities and limitations of the camera in expert hands. It is the purpose of these articles to provide the groundwork of such a knowledge.

There is really only one branch of machine photography in which the engineer can be of assistance—photographs made in the shop under oper-

ating conditions. Photographs of small machine parts are nearly always made in a studio, with a shadow box and overhead camera.

Why Machinery Photographs are Difficult to Make

When a photograph is being made, rays of light travel from a source of light to the object being photographed, which reflects some of the rays to the lens of the camera. The lens bends the rays to a point of sharp focus on the light-sensitive film or plate. In other words, the photographer uses reflected light only, so the reflective power of the subject is of prime importance. If some of the rays from the light source reach walls or ceilings, the light reflected from these areas reaches the subject, and, in turn, is transmitted to the film or plate.

The discussion of light reflection in the preceding paragraph will help the reader to understand one of the main difficulties in portraying machinery with the camera. When a photographer arrives in a machine shop, foundry, or other industrial plant, he is usually confronted by some such situation as the following: The piece of machinery to be photographed consists largely of black or other darkened surfaces on which there are small areas of highly polished metal. Hence, the bulk of the subject has practically no reflecting power, while small parts have too much of it. In addition, the machine is in a congested location, with supporting beams or other obstacles nearby. Sufficient daylight is lacking, so he must depend upon some method of lighting the subject artificially. The walls and ceilings are dark and furnish no reflected light to aid in illuminating the subject properly. To add to the difficulty, the machine, in all probability, has many deep dark recesses extending in various directions.

Preparation for the Photographer

Discerning engineers do all they can to prepare the machinery to be photographed. If the machine is movable, it might be placed outside the plant in daylight (a shadowed area—not sunlight) or in some place in the plant where there is lots of daylight. There are instances when it is desirable to photograph the subject in "natural" surroundings. If that is the case, the company electrician should provide several "plug-in" points for photographic lamps and put 30-ampere fuses in the fuse box to carry the load. Some photographers prefer flashlight (flash powder or the powerful new photoflash bulbs) rather than incandescent or arc light.

The painting of machines to be photographed demands care. A battleship gray with an egg shell finish has been found entirely satisfactory and is widely used. Most machine tool builders now employ machine tool gray. A paint with a dead mat surface gives a wooden appearance, and therefore is unsuitable. Glossy enamel is equally undesirable, as this type of paint causes annoying accentuations of the slightest unevenness of surface. It is better to repaint the whole surface rather than touch up spots and scratches. A soft cloth dipped in paraffin or gasoline is useful in removing oily spots or finger marks.

"Photographic" paint should not be coated on machinery designed to be used outdoors. Acid-resisting enamel is invariably used to coat machinery that must withstand the ravages of the elements; and as this sort of paint is coated directly on the metal, a coat of paint to aid photographing is not permissible. The photographer is "up against it" here, for the light reflected is composed of extremely weak rays from the black areas and shadows and extremely bright rays from the highlight points. Halftone values are absolutely lacking, and unpleasant contrast will surely mar the picture unless a few precautions are followed. How to subdue contrast will be explained in a subsequent article. Some photographers have handled heavily shadowed parts by painting them a lighter shade.

A common problem is presented by trains of gearing or complicated lever systems located in front of similarly colored metal. This destroys relief and gives a flat effect. Painting the background a contrasting shade will correct this trouble.

Backgrounds in Machinery Photographs

Not many years ago, photographers doing machine work almost invariably "blocked out" the backgrounds, picturing the machine against a dead white background, with no visible means of support. This practice is rapidly passing into the discard. The value of realism and the desirability of preserving the photographic effect are leading photographers of machinery into the more modern practice of using natural shop backgrounds.

It would not be correct to say that "blocking out" is not done at all; and in case any readers have occasion to use this type of picture, it is well to describe briefly how it is done and how the engineer can make a few preparations that will help the photographer to do a clean-cut blocking-out job. Machines having complicated and intricate "edge" detail are extremely difficult to block out, particularly when the background is the same tone as the machine. Time spent on long blocking-out jobs costs the customer money.

In order to assist in blocking out backgrounds, a white screen or any material of light shade should be on hand to place behind the machine being photographed. This provides an outline contrast that clearly indicates the minute edge detail to the photographer when he applies opaque to block out the negative. If packing paper is available, a good background screen can be quickly provided. This paper usually comes in 30-inch rolls. It can be suspended from a strong string or wire.

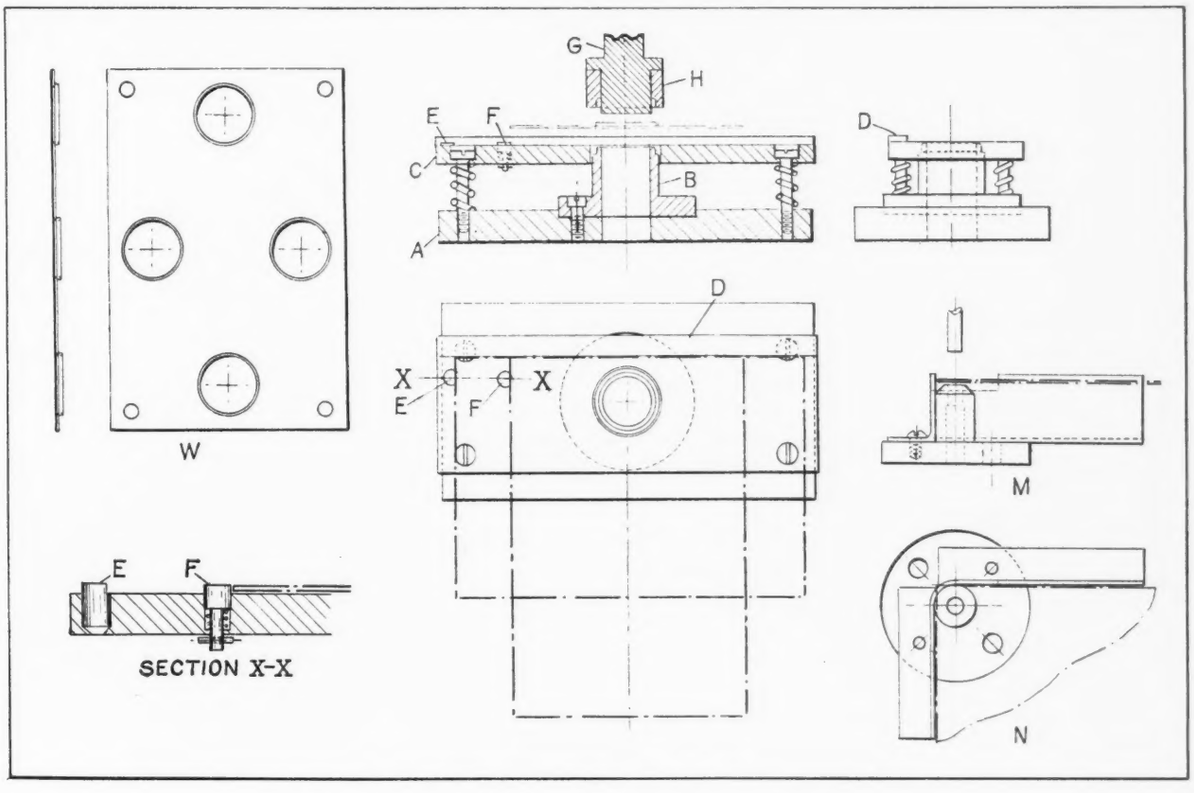
So wide are the varieties of machine subjects and the camera problems they present that it is certainly a wise procedure, and the only fair one, to tell the photographer in detail just what conditions he will face when he arrives on the job.

In a following article specific directions will be given on lens equipment, focussing, and lighting.

Dies for Producing Panels in Small Lots

By S. A. McDONALD, Brooklyn, N. Y.

"How many pieces are wanted?" is usually the first question asked by a die designer when he is given a drawing or a sample of a piece for which he is to design the die or dies. The answer determines whether it will be a series of simple dies or only one or two dies of more or less complicated design. The 1/32-inch brass panel shown at *W* in the illustration could be blanked, punched, and the large holes flanged at one stroke of the press, if production requirements warranted the construction of a die for handling the work in this manner. Such a die would have been made if the order had been for several hundred thousand pieces, but in this case only ten thousand pieces were wanted and the cost of a die of that kind would have been prohibitive. As the blanks could vary 1/64 inch in size, it was possible to slit and shear them from large sheets, a practice that resulted in a saving in stock, as well as the cost of a blanking die.

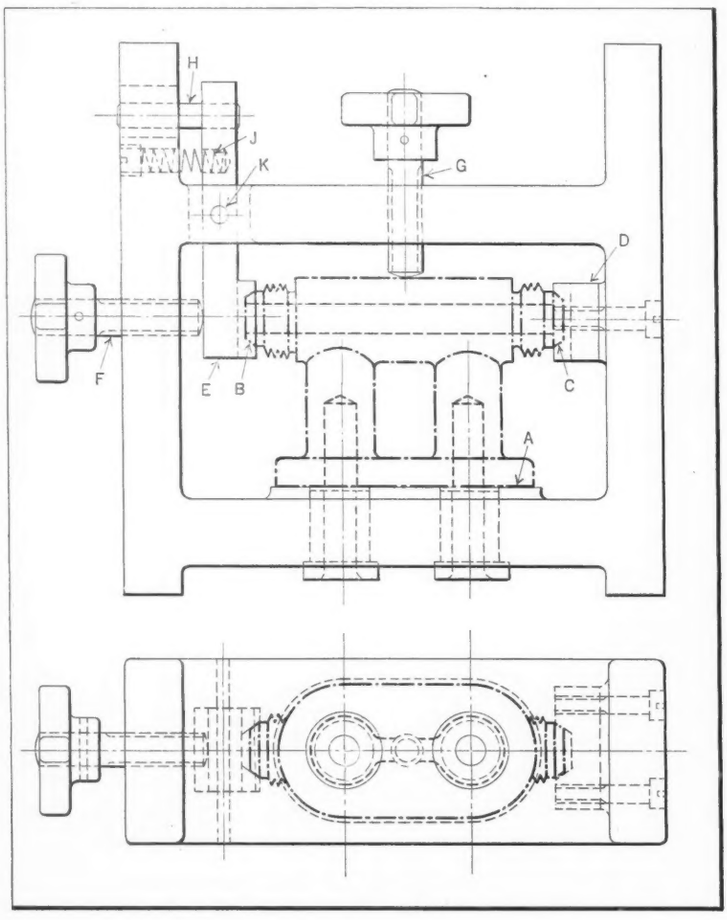


Panel with Flanged Holes, and Dies Used in its Production

The die shown in the illustration was made to punch the four flanged holes consecutively. It consists of the die-shoe *A* in which the die *B* is located, and the stripper plate *C* which is flush with the top of the die and secured to the die-shoe. Around the screws that secure plate *C* are springs which give the necessary stripping pressure. On the stripper is a guide bar *D* which locates the hole in the blank from one edge, and the two locating pins *E* and *F* which locate the hole from the other edge. On the punch *G* is the ring *H* which forms the flange around the hole. The dot-and-dash lines show the position of the work when the holes are being blanked and flanged. The location pins in the stripper are shown in an enlarged section *X*–*X*. The pin *E* is solid, while *F* is of the disappearing type.

When the die is in use, the operator places a blank on the stripper, holding it against the back gage *D* and the pin *F*. As the punch comes down it carries the blank and the stripper down also, punching out a disk which falls down through the bolster into a scrap box under the press. Upon the continued downward movement of the punch, the edges of the hole are drawn over the outside of the die and up into the punch, thus forming the flange. When the punch ascends, the stripper follows it, stripping the blank from the die.

The operator next gives the blank a quarter turn, relocating it against the back gage or stop *D* on top of the disappearing stop-pin, and forcing it down into the stripper; the other edge is located against the solid locating pin *E* ready to punch the second hole. The other two holes are punched in a like manner. When the four large holes have been punched, the operator slides the blank along a table to the next press, where an operator punches the four screw-holes similarly, locating the blank by the gages shown at *M* and *N*.



Jig in which the Work is Located between a Stationary and a Swinging V-block

Jig for Locating Work Having Conical Projections

By F. H. MAYOH, Springfield, Mass.

A drill jig employing a rather unusual means of locating the work is shown in the accompanying illustration. The part to be drilled, which is indicated by heavy dot-and-dash lines, has a finished surface *A*, which, together with the machined conical projections *B* and *C*, is used for locating purposes. These projections engage the stationary V-block *D* and the V-block *E* which swings about the pin *K*.

In loading, the jig is inverted to the position shown. The part is then put in place, and the V-block *E* is forced lightly against the conical projection at the left end of the work by means of the screw *F*. After the work is located in this manner, the screw *G* is tightened down securely, the jig is inverted, and the holes are drilled.

In order to maintain alignment between the stationary and the swinging V-blocks, the latter is equipped with the pin *H*. This pin moves in an elongated slot in the jig and prevents any lateral movement of the swinging V-block. In loading the jig, this V-block is held away from the work by means of the spring *J*.

Finding Minimum Center Distance for Cross-Belt Drive

By W. F. SCHAPHORST, Newark, N. J.

An empirical formula for finding the minimum center distances between the pulley shafts of cross-belt drives has recently been developed by the writer. This new formula takes into consideration certain factors not incorporated in the older ones, and should therefore give more satisfactory results. The new formula, which applies to high-grade two-ply leather belting is:

$$C = 2\,(D + d)\,\sqrt[3]{W}$$

in which

C = minimum practical center distance, in inches;

D = diameter of driving pulley, in inches;

d = diameter of follower pulley, in inches; and
W = width of belt, in inches.

The new formula, which is based on the results of many tests, is limited to drives having 8-inch belts and pulleys up to 40 inches in diameter. A center distance of 25 feet will take care of any ordinary combination of pulleys within these limits.

Assuming that the driving pulley is 12 inches in diameter, the follower pulley 10 inches in diameter, and the width of the belt 3 inches, what is the minimum workable distance between the pulley centers? Applying the preceding formula, the answer is 64 inches.

The same formula can be applied to single-ply belts. The single-ply belts, however, are more erratic in their performance on cross-belt drives than the two-ply belts, owing to the uneven stretching action that so commonly occurs. It is always preferable to use two-ply high-grade belts on drives of this kind.

Occasionally, cross-belt drives are used in which the shafts are as close together as twice the sum of the two pulley diameters. For belts not more than 1 inch wide, this distance may be satisfactory, but for wider belts, the distance is entirely too small, and the twist will be too abrupt. The effect of this is to produce considerable rubbing and wear at the point where the belts cross each other.

Spherical Turning Attachment for Concave or Convex Work

By H. C. MEYERS, Grand Haven, Mich.

With the lathe attachment shown in Figs. 1 and 2, either concave or convex surfaces can be accurately turned to any diameter up to 2 inches. A feature of this device is the rapidity with which it may be set to turn the various diameters. It consists chiefly of the base A, the swivel B, and the column C.

Referring to Fig. 1, the attachment is mounted on the base A, which is bolted to the lathe cross-slide after the compound rest has been removed. In the top of the base is bored a recess which is a free fit for the swivel B. The swivel carries the column C with its tool-block D. The cutting tool is secured in this block, and by turning the knob E on the screw F, which engages a nut in the block, the tool can be raised or lowered until its cutting point is exactly on center. This adjustment is necessary to compensate for the metal removed from the tool in sharpening.

Worm-gear teeth cut in the lower portion of the swivel, mesh with the worm J on the shaft K; and when the crank-handle on this shaft is turned, the column and tool-block rotate as a unit about the center of the swivel, causing the tool point to pass

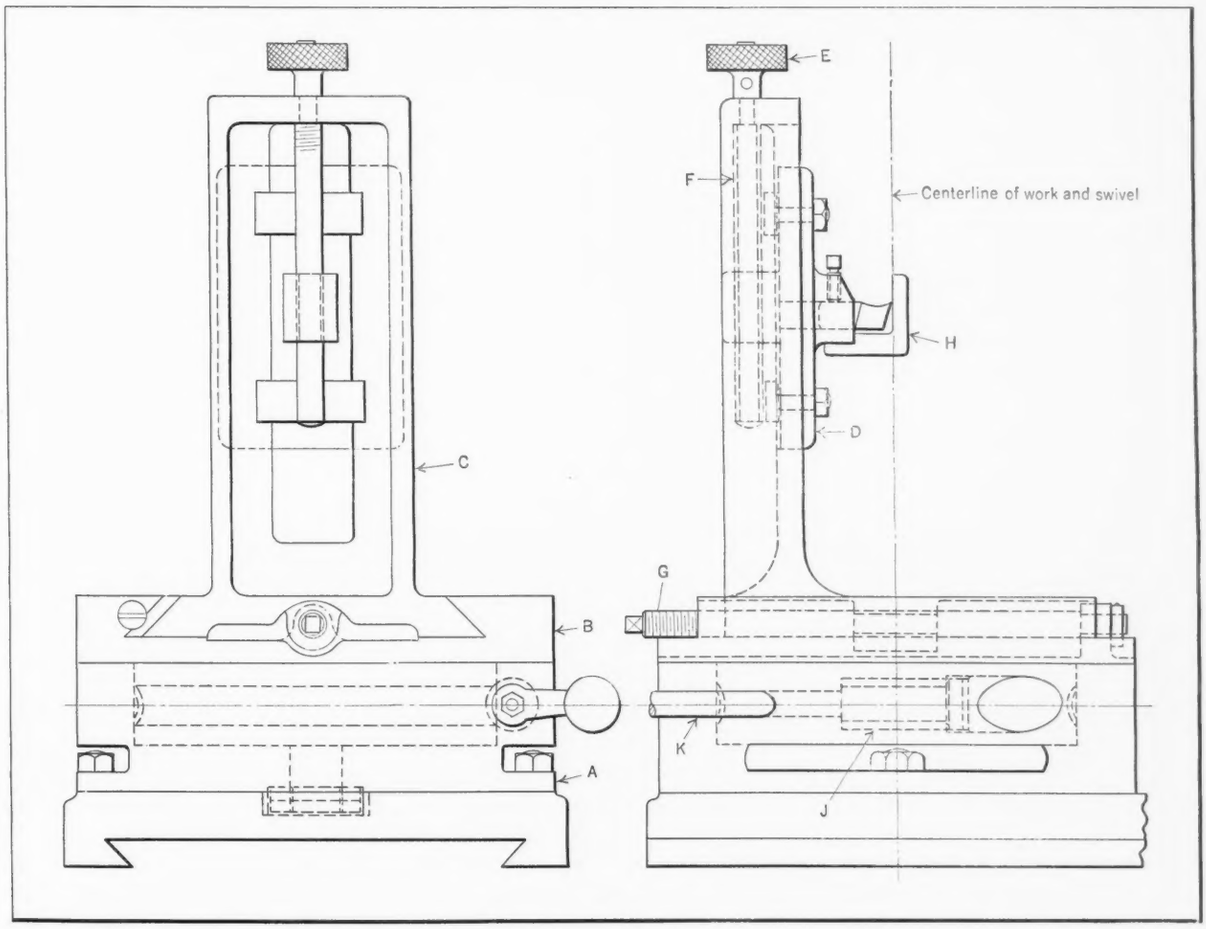


Fig. 1. Lathe Attachment for Turning Concave or Convex Surfaces to any Diameter up to 2 Inches

through an arc equivalent to the curvature of the part to be turned. The radius of this arc may be varied by turning the screw *G*, which transmits a radial movement to the tool.

To facilitate setting the tool point to the required radius, graduations are provided on the swivel. In the position shown in the plan view, Fig. 2, the point of the tool is directly over the center of the swivel and therefore will have no movement when the crank handle is turned. However, by turning the screw *G*, the zero mark on the column can be located at either side of the zero mark on the swivel; the amount and direction of this movement depends, of course, on the radius to be turned and whether the work is to be convex or concave. For concave work, the column is moved to the right until its zero mark is opposite the required graduation on the swivel.

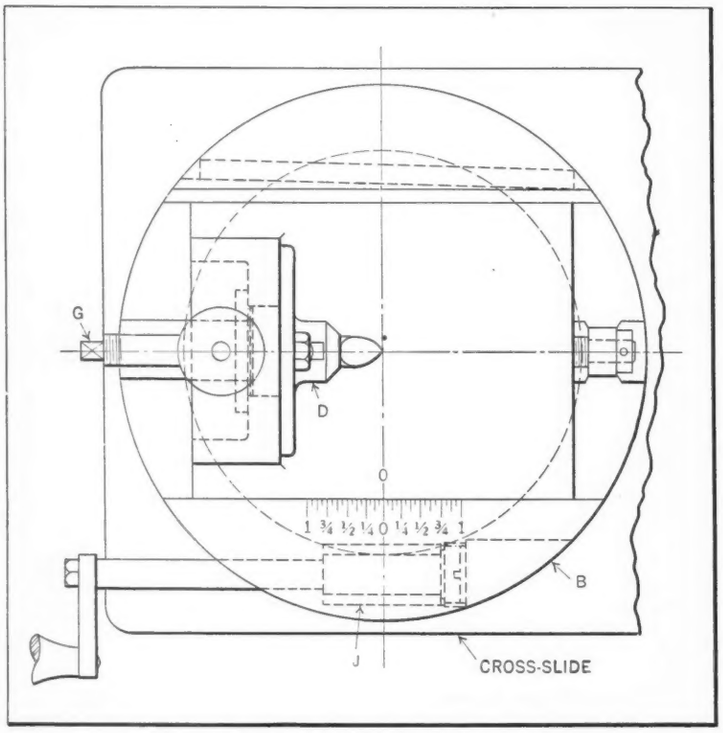


Fig. 2. Plan View of Spherical Turning Attachment Shown in Fig. 1

It is obvious that the tool must be set in the block so that the cutting point will be exactly over the center of the swivel when the two zero marks are opposite each other. The setting is tested by means of the gage *H*, which is shown in position in Fig. 1.

Automatic Milling on the Hand Miller

By RUSSELL A. BLACK, Los Angeles, Calif.

Automobile engine valve spring retainer locks, like the one shown at *W* in the illustration, are turned to size on an automatic screw machine. The slots are then milled on a hand milling machine in the fixture shown. The parts thus produced are used in large quantities.

For the slotting operation, the parts are stacked up in the tubular magazine *A* of the fixture, from where they are automatically fed into the milling position. The fixture is operated by a segment gear *B* which, in turn, is operated by a stationary rack *C*. This rack is fastened to the knee of the hand milling machine by the support *D*, which is clamped to the ways of the machine.

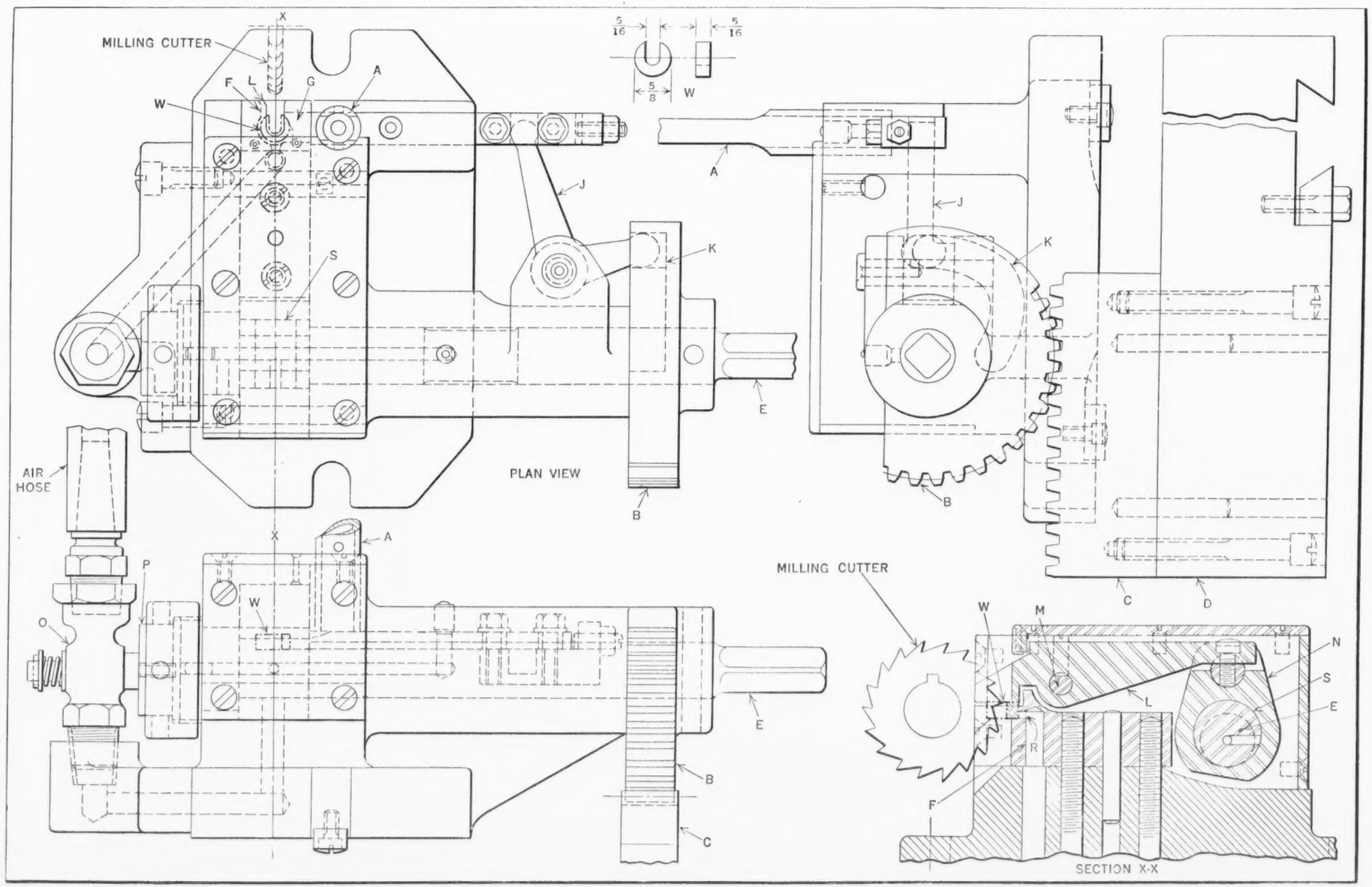
When the milling machine table is fed forward by the hand-feed lever, it carries the fixture forward, causing the segment gear *B* to revolve in contact with the stationary rack. This turns the main shaft *E* through a part of a revolution. This shaft, through suitable connecting parts, serves the various functions of feeding the work into the fixture, clamping it during the cut, ejecting it after the cut, and releasing a blast of air for cleaning the fixture, ready for the next piece.

All the operator has to do is to keep the magazine full of parts and move the table of the machine back and forth. As a matter of fact, the latter operation is now performed by a cam (not shown in the drawing), which is driven through a worm and worm-gear, operated by a belt drive from the cone pulley of the machine. A hopper is now being designed to feed the work into the magazine, so that the milling of the parts will be entirely automatic.

The parts are transferred from the magazine *A* to the locating block *F* by the feeding finger *G*. This finger works through a slot in the fixture. When it comes forward, it carries the lowest piece from the pile in the magazine over to the milling position, indicated by heavy dot-and-dash lines at *W*. The feeding finger is actuated by the bellcrank *J*, which is reciprocated by the positive-motion cam-slot *K*, cut in the side of the segment gear *B*.

After the part has been moved to the milling position, it is held by the clamp *L*. This clamp acts on the top of the work, and is slotted to allow the milling cutter to pass through it. The clamp is pivoted on the pin *M*, and works in a slot in the locating block *F*. The clamp is notched at the front end, as shown, and provided with shields at top and bottom to prevent the chips from working back into the fixture. When the work is being clamped, the rear end of the clamp is raised by an eccentric *S*, turned on the main shaft and operating through the link *N*.

After the slot has been milled in the work *W*, the part is ejected from the fixture by a jet of compressed air. The air also blows out all the chips, leaving the fixture clean and ready to receive another part from the magazine. The air blast is operated from the main shaft *E*. A standard plug valve *O* is attached to the fixture, as shown, with the valve handle projecting into an adjustable block



Fixture Used on Hand Miller for Automatically Milling Slot in Valve Spring Retainer Locks

P, attached to the end of the shaft *E*. One end of the valve is attached to the air hose, and the other is screwed into the base of the milling fixture. The air passes through drilled holes in the base, which lead to a point *R* directly in back of the work. The adjustable block *P* on the end of the main shaft is set to open the valve when the milling machine table is at the back end of its stroke.

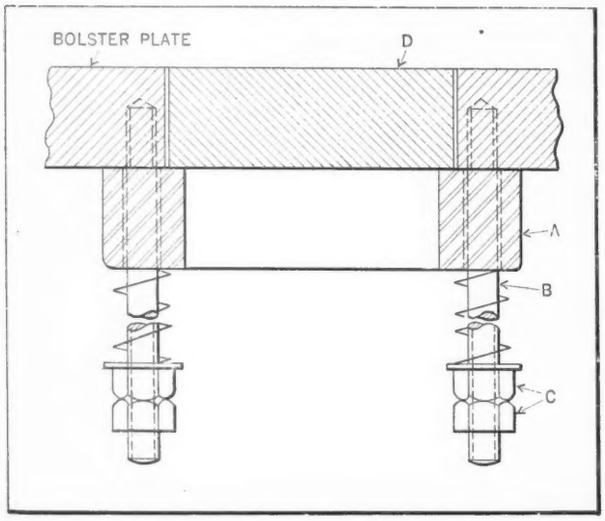
The table movement required for the milling cut is about 1/2 inch. However, the table is actually moved about 3 inches, in order to allow the various movements to take place. The table is, of course, moved rapidly until the work reaches the cutting position and the milling starts. The hand type of milling machine in which the table is traversed by means of a hand-lever lends itself readily to this rapid movement of the table.

Bolster Plate with Spring Pad Arrangement

By EDWARD HELLER, Cleveland, Ohio

By equipping a bolster plate with the spring pad arrangement shown in the illustration, forming dies without the usual pad springs in their lower members can be employed. The arrangement consists of a rectangular steel ring *A* which, by means of the check-nuts *C* and the coil springs on the studs *B*, is held against the bottom of the bolster plate.

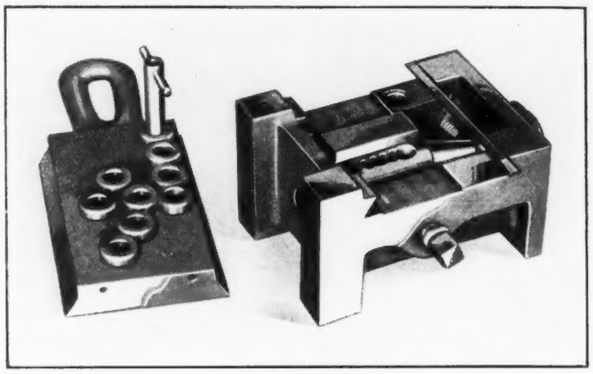
The hole in the ring *A* is about 3/4 inch smaller than the hole in the bolster plate. This leaves a ledge 3/8 inch wide upon which the loose-fitting



With this Attachment for a Bolster Plate, Forming Dies Need not be Equipped with Pad Springs

cast-iron pad *D* rests. The die is bolted to the top of the bolster plate in the usual way. However, the pressure pins in the die are designed so that they will extend through the die bolster and rest on pad *D*. The nuts may then be screwed up until the springs exert the required pressure.

When the press is to be used for blanking, pad *D* is removed to allow the blanks to drop through the die. In case a heavy forming job is to be done and the die is not equipped with pads or strippers, the coil springs may be replaced by short lengths of pipes and nuts *C* screwed up so that ring *A* will form a solid shelf for pad *D*.



Jig in which Overlapping Holes can be Drilled for Forming Slots

Jig for Drilling Elongated Holes

By AVERY E. GRANVILLE, Knox, Ind.

A simple jig for drilling elongated holes or slots is shown in the accompanying illustration. This jig is used for making slots in boring-bars, toolposts, etc. The work is held securely by means of a set-screw, and a slide carrying the drill bushings is slipped into place over it. The slide is located by a T-handled pin which passes down through one of a series of bushings in the side of the slide and into a bushing in the jig body. This brings one of the drill bushings into position over the work. The first hole is now drilled, after which the succeeding holes are drilled, overlapping each other, by inserting the T-handled pin in the pin bushing corresponding with each drill bushing. After all the holes have been drilled, the slot is finished by hand or with an end-mill. The drill bushings are of the slip type, and may be of various sizes to suit the slot width required in the work.

* * *

Report on List Prices and Discounts

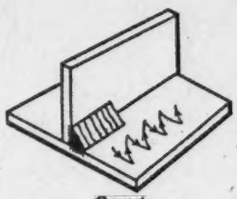
The Joint List Price Committee of the National Supply & Machinery Distributors' Association, the Southern Supply & Machinery Distributors' Association, and the American Steel Warehouse Association, of which committee Wendell H. Clark, 114 N. Clinton St., Chicago, is chairman, has published a report on the "Establishment of Lists and Discounts," which advocates uniformity in methods and outlines specific ways and means by which such uniformity may be achieved. Manufacturers and distributors generally will be interested in this report, and are advised to communicate with the chairman of the committee.

MACHINERY'S DATA SHEETS 219 and 220

ARC-WELDING INSTRUCTIONS*—1

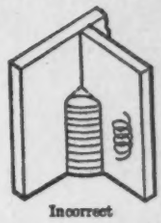
Correct and Incorrect Methods of Weaving or Guiding Electrode in Making Weld

(1) Triangular path requires hesitation at each corner of triangle to insure penetration.



(2) Semicircular motion requires slight hesitation at each end of stroke to insure penetration.

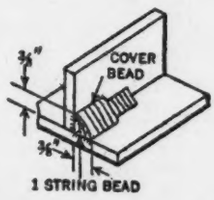
(3) For vertical welds, move faster across hypotenuse to prevent hot metal from rolling over.



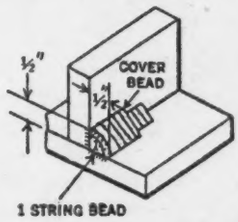
(4) Oval motion of electrode prevents proper fusion in corner of weld, and should not be used.

Method of Laying Beads Parallel with Length of Weld Adopted by the Westinghouse Co. to Insure Good Fusion The Single Beads are Laid with Practically no Weaving.

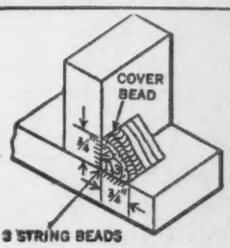
(5) One string bead for 1/4-inch fillet. See (11) and (17)



(6) One string bead and cover bead for 3/8" fillet. See (11) and (10)



(7) One string bead and cover bead for 1/2-inch fillet.



(8) Three string beads and cover bead for 3/4-inch fillet.

*Based on data in a paper read before the American Society for Testing Materials by R. Kraus of the Westinghouse Electric & Mfg. Co.

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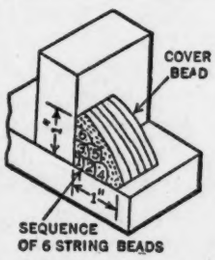
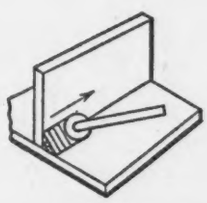
ARC-WELDING INSTRUCTIONS*—2

Method of Laying Beads Parallel with Length of Weld Adopted by the Westinghouse Co. to Insure Good Fusion The Single Beads are Laid with Practically no Weaving.

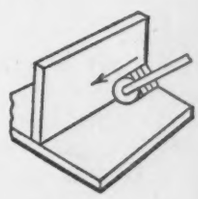


(9) Six string beads and cover bead for 1-inch fillet.

(10) Path of electrode for applying cover bead. Weave cover bead 30 degrees diagonally.



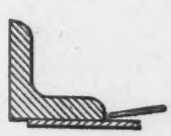
(11) Correct relation of rod to molten metal. Rod perpendicular to face of pool.



(12) Incorrect relation of rod to molten metal. Rod parallel with face of pool.

(13) Correct position of welding rod for materials of about the same thickness.

(14) Incorrect position of welding rod for materials of about the same thickness.



(15) Correct position of rod for welding 1/8-inch sheet-steel plate to a heavy angle-iron.

(16) Correct position of electrode for welding materials of unequal thickness.

(17) A short arc must be maintained consistently, the length being kept about equal to the diameter of the rod used.

*Based on data in a paper read before the American Society for Testing Materials by R. Kraus of the Westinghouse Electric & Mfg. Co.

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Depreciation in Machine-Building Plants

A Study of the Factors Pertaining to Depreciation, Particularly as it Concerns the Manufacturer of Machinery and Tools

By THOS. B. FRANK, Treasurer
The Cincinnati Planer Co.

THE writer has always felt that depreciation was more than a mere intangible something that one is allowed to deduct from earnings by the Internal Revenue Department, in reporting taxable income. He has also felt that depreciation was more than the usual wear and tear on plant facilities. Many other factors cause equipment to depreciate in value, such as obsolescence, inadequacy of design and productivity in times of capacity operation, and inadequate use in times of depression.

We may assume that the principles of depreciation are generally understood, and proceed to consider some of the factors that have influenced many machine manufacturers in determining the policies for handling this element of production cost.

Depreciation Must be Considered as an Element in the Cost of the Product

Depreciation must always be considered as an element of cost. It is the actual cost of using plant facilities that are gradually consumed in the production of the plant's products. That cost is present in the same manner as the costs of labor and material. The only difference is in the long life of the plant facilities, as compared with the current consumption of the labor and material. It is unfortunate that accounting procedure always considers depreciation as an element of overhead or burden, because it is as much a direct cost of production as the direct labor and direct material. Eventually, I believe that this will receive more consideration and that methods will be devised whereby such costs will be charged directly to production.

Without including depreciation in costs, there is no way of arriving at adequate and accurate returns on the cost of plant facilities. All costs and expenses, whether they be apparent or invisible, must be recovered, plus a profit, in the price asked for the product, if the business is to continue its existence. Therefore depreciation must be included in costs and recovered in selling prices. It would be a very narrow-minded customer indeed who would expect to pay a price for his purchases that did not assure the continuance of the business and the service that his supplier is furnishing him.

Depreciation Should Take Care of Maintaining Plant Equipment in Up-to-Date Condition

From the standpoint of the investor or stockholder the need of an adequate allowance for depreciation is apparent. Stockholders should expect their investment to be maintained intact. Without adequate depreciation allowances, accurately determined and recovered in selling prices, no business can hope to maintain investments in plants and equipment. Buildings and machinery are worn out and otherwise rendered useless in the ordinary course of business, and must be replaced. The cost of such replacements must be recovered. Stockholders expect the business they have invested their money in to be self-sustaining. No investor expects to be called upon to supply additional funds with which to finance replacements, nor should he be called upon for such additional investments. To do that would be an evidence of faulty management.

Thos. B. Frank, treasurer of the Cincinnati Planer Co., Cincinnati, Ohio, was born in Lincoln, Neb., in 1894. His first industrial experience was with the South Bend Chilled Plow Works, South Bend, Ind. Later he engaged in public accounting work, system installation, and income tax practice in Cincinnati, several years prior to entering the employ of the Cincinnati Planer Co. He has been active in the National Association of Cost Accountants; he served as president of the Cincinnati Chapter in 1927-1928, and has since been a member of the national board of the Association. He has also served on the Cost Committee of the National Machine Tool Builders' Association. Many of his papers presented before technical and business associations have been published in trade and technical journals.

Depreciation Must be Computed on Present Cost of Replacement

A feature of prime importance in the consideration of depreciation is the basis for making computations; by this I mean the valuation of the properties that are being used. The original cost of the plant buildings and equipment is one figure and the value at any given time is another. Values change materially over a period of years, and the original cost of a plant built and equipped in, say, 1910 may be only 60 per cent of the value of the same plant today. It is apparent that depreciation computations based on the original cost in 1910 would mean very little in determining today's cost of production and today's selling price.

Much has been said by accountants and business executives regarding the propriety of using depreciation figures based on original cost and those based on current values. The fact remains that the wide-awake business executive must have cost figures pertaining to the current moment; competition demands that present-day figures be used in determining all business policies. Current prices for labor and materials are used without question, and it follows that depreciation should be based on the cost of replacing plant and equipment at the present time.

It must be remembered that depreciation is nothing but the money value or cost of the wear, tear, obsolescence, and loss of usefulness of plant facilities. Such cost should, therefore, represent the present-day cost, and not a cost based on what the plant investment originally was in 1910. It matters not whether the value today is above the original cost or less. The principle is the same, and it is merely a matter of accounting, combined with expert engineering appraisal, to determine proper present-day values, and make depreciation computations.

Rates of Depreciation Must be Computed to Cover Obsolescence

Next in importance is the setting of proper rates for depreciation. Ordinarily the expected useful life of a building or piece of equipment should be the determining factor. However, in many instances, especially with modern production machines, the expected life of a machine and its actual useful life may be two entirely different things. Invention of new processes, advanced design, and many other factors, may cause an overnight obsolescence. Modern trends in machine design make it highly unprofitable to continue the use of many machines that were purchased as recently as five years ago. Therefore depreciation rates should be set only after making due allowances for all these factors.

In the past, a general 10 per cent rate was considered adequate for all purposes. Today many machines should be depreciated at 25 per cent, while for others a 10 to 15 per cent rate would be sufficient. Even building design is changing rapidly. A building built in 1910 may be entirely unsuited to the business requirements in 1932. As a result, the commonly used rate of depreciation for buildings of 2 to 3 1/2 per cent would be inadequate. It is true that in many cases it would be impracticable to abandon plants or spend great amounts of money for modernization; nevertheless, the factor of obsolescence remains a cost of doing business. This cost will eventually cause trouble and loss for the business if it is not included in the cost of production.

A great many business executives have allowed their business policies, in so far as depreciation is concerned, to follow the dictates of the Internal Revenue Department, although, for the purpose of their own production and control, entirely different depreciation policies should be followed. How foolish it is to use a flat 5 per cent rate for depreciation based on the cost of a machine in 1915, when it is known that the present-day value of a new machine is 135 per cent of the original cost, and that a newly designed machine has rendered the old one 80 per cent obsolete. A reconciliation of the company's rates and values with those required by the Revenue Department may be easily made by any good accountant, and there is no sense in fooling one's self for the sake of maintaining a simple and easy method of computing depreciation costs. Modern business methods simply will not permit such policies.

We are uncertain as to when the turn in business will come, but we are certain that the turn will come. We are likewise certain that the period of stress through which we are passing is the foundation for greater and sounder progress in the future. Industry must recognize this as a period of wholesome reconstruction. Those who first recognize the situation in this light will be the ones to profit most. They will profit in better returns from actual business at the present time and still more in the future, when the efficiency and strength developed in making ends meet under adverse conditions can be applied to normal operations.—F. A. Merrick, president, Westinghouse Electric & Mfg. Co.

Rapid Forming of Multiple Bends in Tubing

Some Excellent Examples Showing the Simplicity of the Fixtures Employed and How Uniformity in the Product is Obtained

By J. E. FENNO

BENDS in seamless brass and copper tubing up to 3/8 inch in diameter are produced in a plant manufacturing various types of centrifugal pumps by means of hand-operated bench fixtures. Bent tubes of various shapes are required for these pumps, but the quantity of each shape does not warrant expensive tooling equipment, although economy and rapid operation are required. To illustrate how these requirements were met, a few examples of the most interesting fixtures used for this work will be described.

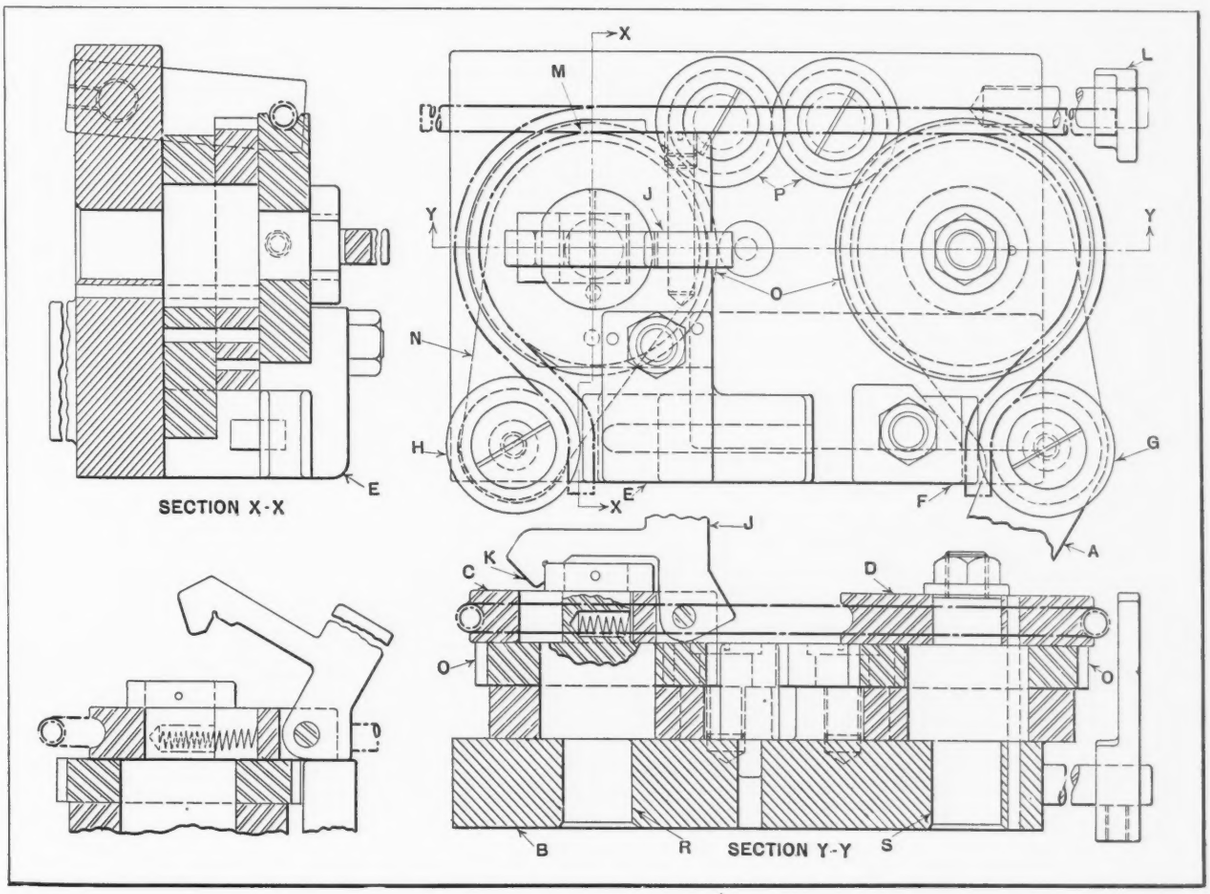
In Fig. 1, a fixture is shown in which the outline of the tube before and after bending is indicated by the heavy dot-and-dash lines. Here, four separate bends are made simultaneously at one swing of the hand-lever *A*. All the working parts of the fixture are mounted on the plate *B*, the under side of which is provided with a projection so the fixture can be held in a bench vise in a convenient position for the operator. Projections of this kind are provided on all the fixtures.

Fig. 1. Four Bends are Made Simultaneously in this Fixture. The Use of a Sliding Form Facilitates the Removal of the Formed Tube

The two bends of large radii are made by bending the tube part way around the forms *C* and *D* by means of the rolls *H* and *G*, the latter swinging about the center of the forms. The two small bends are produced as the ends of the tube are forced against the grooves in blocks *E* and *F*. The rolls are mounted on levers *N* and *A*, which turn freely upon the stationary studs *R* and *S* assembled in plate *B*. By means of the gears *O*, doweled to levers *N* and *A*, and the idler gears *P*, the movement imparted to roll *G* by lever *A* is transmitted to roll *H*. This arrangement permits all the bends to be made with one lever.

It is obvious that, after the bends have been produced, it would be impossible to remove the finished tube from the fixture unless provision were made for doing this. To allow this to be accomplished, form *C* was designed so that it could be unlocked and moved a sufficient distance to the right to permit the removal of the tubing.

As shown in the lower right-hand view, the form *C*



is in its locked position. By swinging the lever *J* toward the right, the latch *K* is raised. This releases form *C*, which is immediately forced toward the right by the coil spring, allowing the tube to be lifted past the flanges of the forms. It will be noted that block *E*, being bolted to form *C*, is also moved to the right when latch *K* is raised, providing the necessary clearance near the ends of the tube for removing the formed tube from the fixture.

In operation, lever *A* is first swung around to the right into its starting position, moving rolls *H* and *G* to the rear of forms *C* and *D*. Although not shown, lever *A* is offset enough to clear the top of the tube stop *L*. A length of tubing is now passed between the forms and the rolls until it comes in contact with the tube stop. Lever *A* is then swung to the left, causing the rolls to bend the tubing around the forms and against the blocks *E* and *F*. The lever is now swung back to its starting position, and the form *C* unlocked and moved to the right by means of the coil spring, thus permitting the formed tube to be removed from the fixture. To further facilitate the removal of the tube, the upper part of the flange at *M* on the form *C* is cut away. It will also be noted that the bending rolls are set ahead of the bending point of the tube, instead of directly over this bending point. This arrangement prevents much of the tube distortion that would occur if the rolls were in this position. Locating the rolls in this way also provides greater clearance between the forms and rolls, thus facilitating the removal of the finished tube.

Making Bends in Different Planes

Two lever movements are required in the fixture shown in Fig. 2 to form the three bends indicated by the heavy dot-and-dash lines. One of these bends *A* is made in a plane at right angles to the other two. The action of the bending rolls is similar to that in the fixture shown in Fig. 1. However, the method of removing the tubing after the forming operation is different.

In operation, a length of tubing is passed between the two forms *B* and *C* and against the adjustable stop *D*. The operating lever *N* is now swung to the right until it is in contact with the stop-pin *E*, bringing the bending rolls *F* and *G* to their starting position. Next, the lever is swung to the left and the two similar

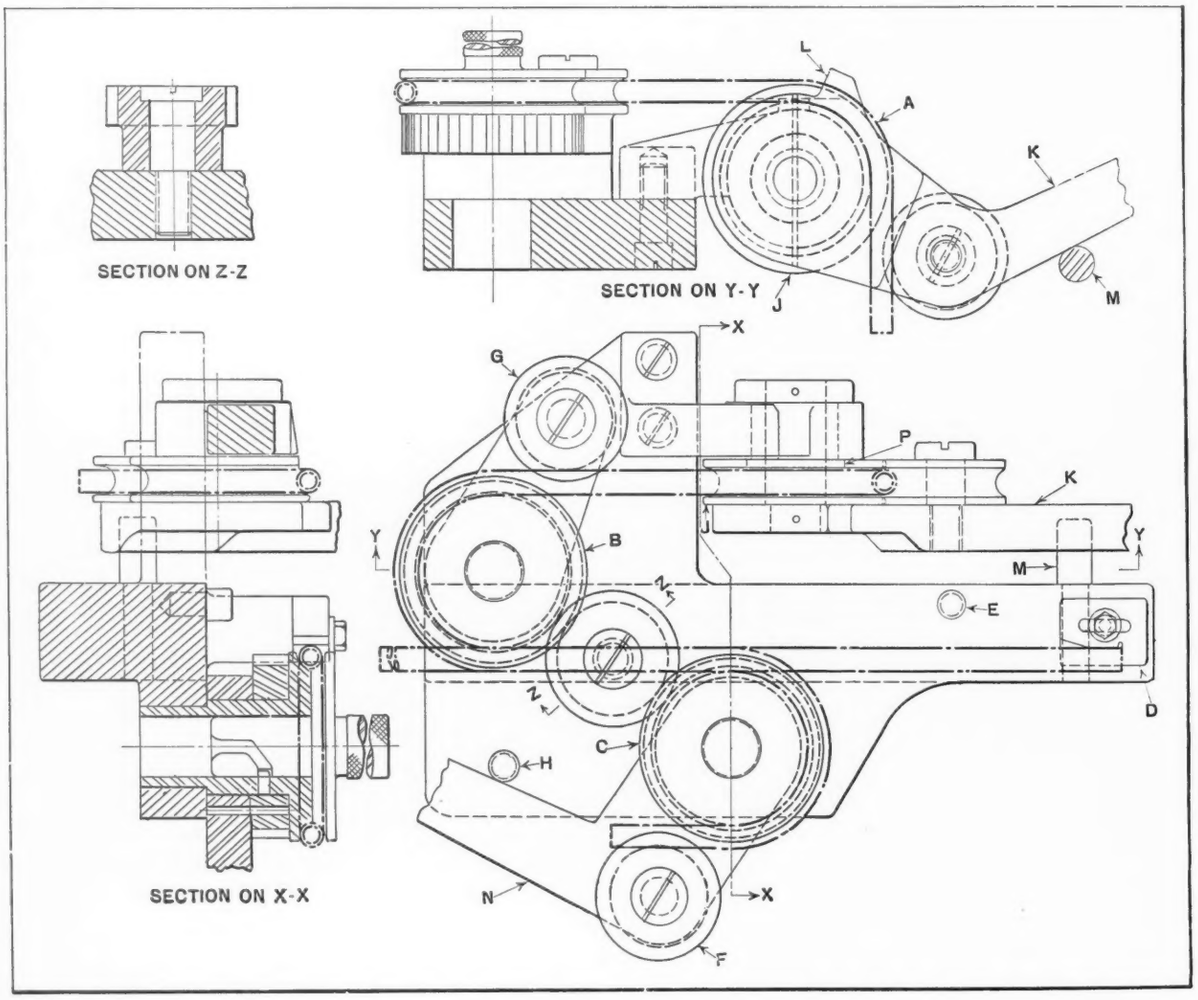


Fig. 2. Only Two Rapid Lever Movements are Required to Make the Triple Bend Shown by the Heavy Dot-and-dash Lines

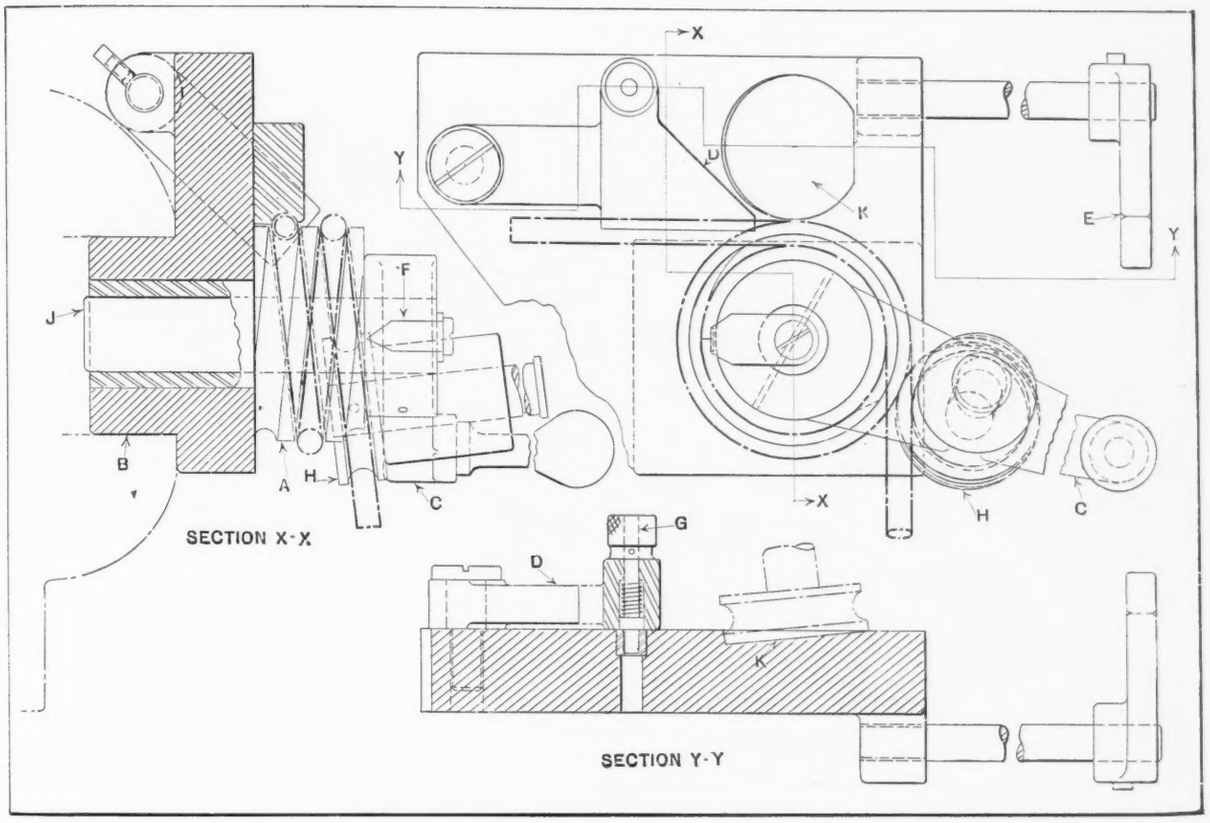


Fig. 3. The Tubing is Coiled by being Wound Around a Form by Means of a Roll which is Actuated by a Lever

bends are formed, the movement of the lever being limited by the stop *H*.

As these two bends are completed, the long free end of the tubing swings past the milled edge *P* of the form flange and into position over the form *J*. At this time, the lever *K* is in its upper position, with stop *L* resting on the base of the fixture. This lever is now swung down to the position shown in the upper view, where it comes against the stop *M*, completing the final bend in the tubing.

To remove the tubing from the fixture presented a problem. This was solved by making the upper halves of the two forms *B* and *C* removable. To facilitate their removal, bayonet locks, one of which is shown in the sectional view *X–X*, were provided. The position of the lever *K* after making the final bend is not changed before removing the finished tubing.

Fixture of Simple Design for Coiling Tubing

Tubing is coiled rapidly in the fixture shown in Fig. 3. The coil is formed around the member *A*, the cylindrical surface of which is provided with a helical groove corresponding to that of the required coil.

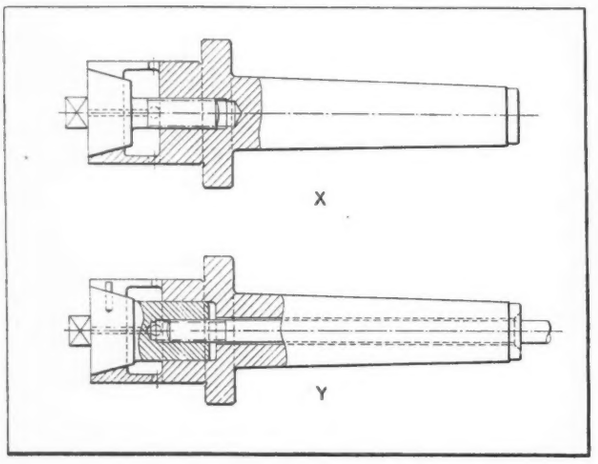
The lower end of member *A* is shown in the view of section *X–X*. It is turned down and is a drive fit in the baseplate *B*. The forming roll *H* in this case is mounted on a sliding shaft in the lever *C*. The shaft is positioned on this lever at the same helix angle as that of the helical groove in *A*, and the roll rises with this shaft as it follows the path of the coil. The plug *J* in one end of the lever is a slip fit in the bore of member *A*, so that the bending roll is always the same distance from the center of the coil while the lever is being operated.

In forming one of these coils, the tubing is fed between the member *A* and the support *D* until it comes in contact with the adjustable stop *E*. At this time the lever *C* is in a position at the rear of the fixture so that the forming roll *H* rests in the depression *K* in the baseplate. As the lever is swung in a clockwise direction, the roll bends the tube about member *A* and continues to do so until the lever has made slightly more than one and one-quarter turns. The end of the lever movement is governed by the position of the pointer *F*, which, at this time, corresponds with a mark scribed on the top of member *A*. After completing the bend, the movement of the lever is reversed enough so that it can be removed with the bending roll from the fixture. Plunger *G* is now raised, the support *D* swung back, and the finished tubing removed by unscrewing it from the member *A*.

To arrange the fixture for bending the next tube, support *D* is swung back to its former position and lever *C* placed in the fixture with the bending roll resting in the depression *K*. It would be well to note that in this fixture, as well as in the others, the stops are arranged in a suitable position to compensate for the springing back of the tubing.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work



The Improved Expanding Arbor Design at Y Maintains Concentricity of the Work

Expanding Arbor that Retains Its Concentricity

Because of the frail construction of expanding arbors like the one indicated at *X* in the illustration, their expanding ends are easily distorted, thus destroying the concentricity of the work. In the design shown at *Y*, this difficulty has been overcome by extending the tapered plug so that it slides in the body of the arbor. Instead of the threaded portion indicated in the upper view, the plug has a tapped hole for the lathe draw-bar. The draw-bar then serves to tighten the work on the arbor. Thus it will be seen that not only is concentricity of the work maintained, but loading and unloading is also facilitated.

J. W. H.

Using Scotch Tape in Place of Thumb-Tacks

The problem sometimes arises in the drafting-room of tracing a drawing in which the draftsman does not want to put a thumb-tack. Paper clips do not hold the tracing paper and original together tightly, and glue or paste leaves the drawing and tracing in a messy condition.

For such cases it is handy to have available a roll of Scotch decorators' tape, which can be purchased at decorators' and photographic supply shops for about twenty-five cents. The tape is easily torn and resembles adhesive tape in that it grips the surface well. However, the decorators' tape has the advantage of leaving no sticky mark whatever, the sticky surface remaining on the tape. For this reason it can be used over and over again. This characteristic is probably what gave the tape its name.

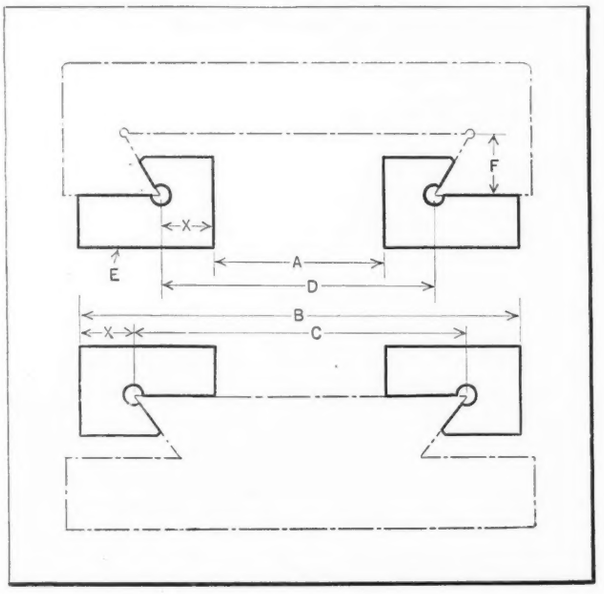
Another use for the tape is in cases where it is desired to trace a small drawing on which the draftsman wishes to work at all angles. The drawing and tracing can be fastened together with the tape and moved all over the board at any angle, facilitating lettering in difficult positions. Also, if the work is to be taken home, the drawings can be carried home together, with the two pieces held firmly in the same relative positions, thus saving the time of re-tacking the papers to the board.

Use of small tabs of the tape enables the draftsman to hang the drawing quickly against the wall to dry after inking in.

New York City — CLIFFORD STROCK

Angle-Blocks for Measuring Dovetails

Difficulty is often experienced when rods are used for measuring dovetail slides and gages like those shown in the illustration. This is due to the tendency of the rods to climb up on the angular surfaces as the measuring tool is applied. To avoid this condition, the writer employs the two angle-blocks *E* instead of rods. When a female dovetail is to be checked, the blocks are positioned as shown in the upper view, and the measurement is taken between them as indicated at *A*. To this measurement is added twice the distance *X* in order



Simplified Method of Measuring Dovetails by the Use of Angle-blocks

to obtain the dimension D; and this sum should check with the gage or part drawing.

Distance X is constant for dovetails of all sizes whose sides are at the same angle. This constant is, therefore, stamped upon the block. The height F may be checked accurately by means of a height block.

For measuring the male member of a dovetail, a similar procedure is followed, with the exception that the angle-blocks are reversed, as shown in the lower view, and instead of adding, the value of twice the constant is subtracted from the reading B to obtain the dimension C. The dimension C should check with the dimension specified on the gage or part drawing.

Niles, Mich. GEORGE GARVIN

Cellophane for Repairing Tracings

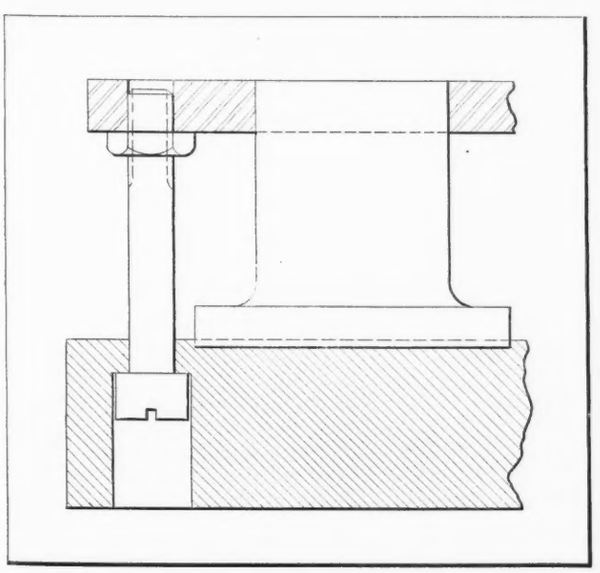
The new cellophane tape for repairing tracings, which requires no moisture in its application, can be used to advantage in replacing small obsolete sections of a tracing with a new piece of tracing cloth on which the new design is traced. The tracing cloth should be placed underneath the original tracing and the replacement piece cut out by the same strokes of the knife that cut the hole in the original tracing. The new piece may then be attached with the cellophane tape.

Auburn, N. Y. W. S. BROWN

Adjustable Retaining Screws for Stripper

In compound dies, the stripper plate is usually adjusted for height after an appreciable amount has been ground off the top of the die in the sharpening process. This necessitates the removal of the shoulder-screws in the stripper plate in order to shorten the distance between the shoulder and the head, and thus compensate for the reduced height of the die. With the type of screw shown, the adjustments may be made by means of the check-nut without disturbing the set-up. Though this screw is shown assembled in a compound die, it may also be used in either the upper or the lower members of other types of dies.

New York City F. J. WILHELM



Stripper Plate Having Means for Adjusting Height without Disturbing Die Set-up

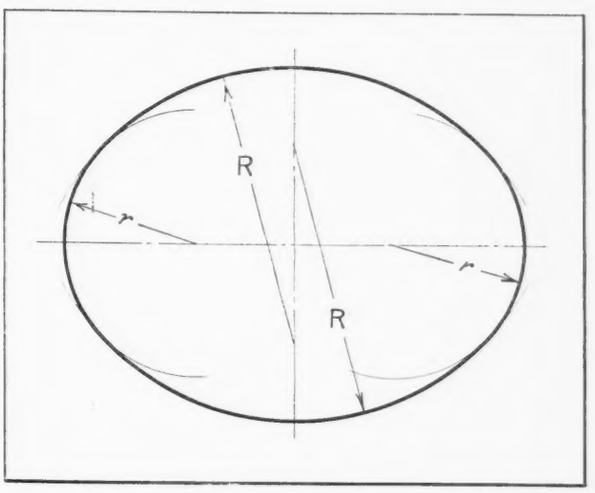


Diagram Illustrating Method of Drawing Approximate Ellipse

Method for Drawing Approximate Ellipse

A method of drawing an approximate ellipse was described in August MACHINERY, page 942. Another and somewhat shorter method is given here. With this method, only the radius r, indicated in the accompanying illustration, need be calculated, and this is quickly accomplished, as we have $r = \frac{b^2}{a}$, in which a equals one-half the major axis and b equals one-half the minor axis. The radii R, being tangent to the arcs of radii r and passing through the extremities of the minor axis, as shown, are determined by trial.

Brooklyn, N. Y. R. V. RAYMOND

Removing the Broken End of a Hardened Screw

Recently the writer had occasion to remove the broken end of a hardened screw from the bottom of a ¾-inch counterbored hole. The screw was broken off short and clean in a valuable machine part. The broken end could not be loosened with a punch or chisel, and we did not want to anneal it as the heat would be likely to spoil the part. By electric-welding a top on the screw that extended above the counterbored hole, the writer was able to unscrew the broken end with a Stillson wrench.

R. P. M.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

D. M.—I understand that there is a method used for milling depressions in die-blocks so that an internal square corner is obtained. A pencil mill is used, set at such an angle that it is possible, with one setting, to mill both of the sides that make up the internal corner, and also the bottom of the depression square with the sides. I would like to see this method described and a formula given for setting the milling attachment spindle, as it is obvious that the angle of the spindle and the angles of the sides of the pencil mill must bear a certain relation to each other.

This question is submitted to MACHINERY'S readers.

Printed Notices on Order Forms

J. F. M.—Please state the law with respect to the legal effect of a printed notification on a letter-head or order form. A few days ago, I received a letter from a dealer which described a used machine to be in excellent condition. The letter said: "We offer this machine to you at $1500. Please accept our offer by return mail if you are interested." At the top of the letter-head was printed the notification: "All quotations subject to change without notice and to goods being unsold." We answered this letter at once and accepted the offer, sending our check for deposit. Several days later we received a letter from the seller calling our attention to the printed notification, and enclosing our deposit check, with information that the machine had been sold to another party before our letter was received. Have we any right of action against this firm?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

Under the circumstances you mention, you have a legal right to compel the seller to deliver the machine or pay damages, particularly for the reason that he made you an absolute offer to sell the machine. If, however, he had directed your attention to the printed notification or had explained that the offer was being made subject to the machine being unsold when your order was received, you would have no right of legal action. The law is well established that a printed statement or notice on a contract, bill-head, bill of lading, or letter-head is not effective, particularly if the printed statement is contradictory to the statements contained in the body of the contract or letter. Moreover, it has been held that a stipulation printed in small inconspicuous type is not effective, unless referred to in the body of the letter or contract.

In a leading case (64 S. E. 553), a contract of sale contained the printed notification: "All agreements are contingent upon strikes, accidents, and other delays beyond our control." Owing to the impossibility of obtaining raw material, the seller could not deliver the merchandise. The buyer sued to recover damages, because he was compelled to buy the goods elsewhere at an advanced price. The seller defended the suit on the contention that the printed notification relieved him of liability for failure to fulfill the contract. However, the Court held the seller liable in damages, saying:

"If a contract in writing is plain and clear and unambiguous in its terms, *it is not subject to modifications by a statement in a letter-head, printed at the top of the paper,* which is not incorporated in the contract and is inconsistent with it. Even where a printed form of contract is used, but terms are written into it which are at variance with the printed matter, the writing will control."

Also, in another case (126 Ill. App. 253), a seller wrote "until otherwise advised, the price on coal for future orders will be . . . $2.50 for pea coal." His letter-head contained the printed notice: "Quotations not binding until orders are accepted, and are then subject to all contingencies beyond our control, advances in mining or rates of transportation." The buyer immediately ordered several cars of coal, but in the meantime the mining rate advanced and the seller attempted to increase the quoted price. However, the Court held the buyer not bound by the printed notice. Also, see other cases as follows: 124 S. W. 1107; 223 Fed. R. 704: 246 Pac. 332.

The only condition under which a printed notice on a letter-head, bill-head, order form, etc., is valid is when the notice does not in any manner conflict with the terms stated in the body of the letter or contract. In other words, a seller cannot positively offer a machine at a definite price and then rescind the contract by referring to a notification printed on the contract sheet. The Courts take the stand that the buyer is legally bound when he accepts an offer or signs a contract, and so also is the seller obligated to the same extent, irrespective of printed notifications.

* * *

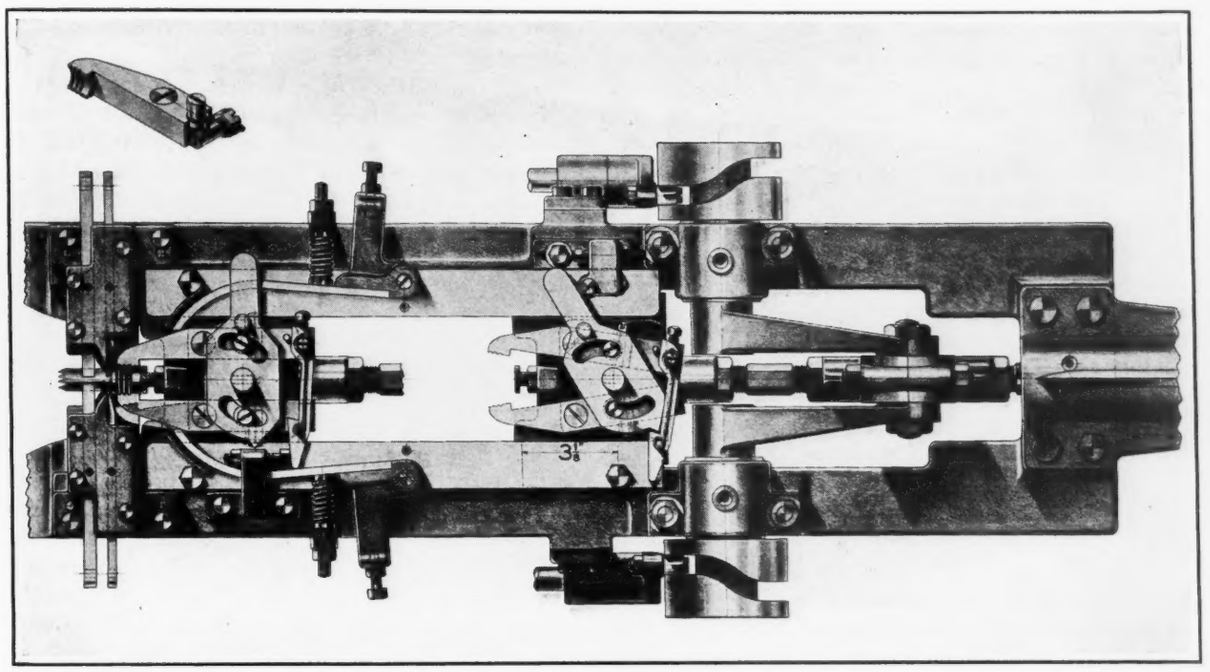
Regardless of what the conditions are in the other nations of the world, we believe that 1932 will be a year of revival in the United States. If it is not, it will be our own fault and chiefly due to our own lack of confidence, courage, and cooperation.—From *Looking Ahead,* by Alvan T. Simonds and John G. Thompson, Fitchburg, Mass.

Shading Used to Visualize Designs

By E. A. TERRELL, President
The Terrell Machine Co., Inc.
Charlotte, N. C.

THE article "New Designs Visualized by Shade Drawings," on page 262 of December MACHINERY, was noted by our company with considerable interest. We have been using a similar method of illustrating instruction manuals, parts catalogues, and published articles describing attachments for the machines we manufacture.

The method we use requires somewhat more time for execution than the one previously described, but we believe that the results obtained are well worth the additional time. The accompanying illustration is a reproduction of a photograph made of one of our drawings. In some cases, the part numbers and identification arrows are placed on the drawing, but in other cases these numbers and arrows are drawn on tracing cloth fastened over the drawing. The latter method requires double printing in making the engraving, but it leaves the original drawing in such shape that it can be used for other purposes.



Example of a Shaded Drawing, Showing Different Positions of the Same Mechanism

For shading, we use a Conté crayon. The blending of tones is done in the regular manner by using tortillon stumps which may be purchased in any art store. Flat even tones are easily produced, and graduations of shade from high-light to dead black are readily secured by the use of these crayons. Occasionally, when we want a very dark black, we use a grease pencil. With a little understanding of angles of light, shadows, and high-lights, one can produce a creditable job without previous training.

The advantages of this method of illustration are: (1) The drawing is visualized with photographic clarity while retaining engineering accuracy; (2) phantom views, sections, and parts or assemblies in two different positions can easily be shown on the same drawing; (3) the same method of shading is applicable to isometric drawing.

* * *

In a booklet published by the National Association of Manufacturers, 11 W. 42nd St., New York, entitled "Profits versus Competition," attention is called to the great increase in the number of people engaged in the distribution of products, as compared with those engaged in production. For example, in 1900, out of the total number of people engaged in industry, 79 per cent were engaged in production and 21 per cent in distribution; in 1920, only 70 per cent were engaged in production and 30 per cent in distribution. The 1930 census figures are not yet available, but from the trend during the twenty years from 1900 to 1920, it is probable that the number of people engaged in distribution is now very nearly equal to the number of people engaged in production.

In the booklet mentioned, the following conclusions are drawn: (1) That at least 30 per cent of the consumer's dollar is spent for distribution; (2) that this proportion is increasing markedly from year to year.

A Free-Machining Stainless Steel

A PATENT was recently issued to Frank R. Palmer of the Carpenter Steel Co., Reading, Pa., covering the composition of a free-machining stainless steel containing essentially between 7 and 30 per cent of chromium and between 0.15 and 1.80 per cent of sulphur. Since free-machining properties have been difficult to obtain in corrosion-resisting alloy steels, the new development is of considerable importance to all users of steel. To appreciate the value of the new development, a brief review of the history of stainless steel may be of interest.

Stainless steel was first manufactured commercially in this country in 1917. In 1928, when the application for a patent on the free-machining stainless steel mentioned was filed, there were dozens of different analyses of corrosion-resisting steel. Up to that time, however, the application of this material had been seriously retarded by the fact that it could not be machined with standard tools at ordinary production speeds.

Other difficulties were also met with in the use of high-chromium steels. They have an inherent tendency to seize other metals with which they are brought into contact under high pressure. This characteristic has been termed the "high frictional quality" of the metal. It is this quality that is responsible for the difficulty encountered in machining chromium steels, since it causes the chips to adhere to the cutting edges of the tools, interfering with both the speed of machining and the finish on the material being machined.

Cold drawing operations on wire and tubes have been performed through the use of metallic coatings of copper or lead which were applied to the high-chromium steel before drawing, so that the steel would not come in contact with the drawing die.

Grinding and polishing operations were expensive and difficult, because the particles abraded from the chromium steels would quickly load up the wheel and overheat the work. The wheel had to be dressed continually.

In straight turning jobs, it was found that by grinding the top rake of the tool to a very steep angle, easier cutting conditions were obtained. If the cutting angle was steep enough, the chips would slide off, but the angle necessary was much greater than that usually employed on cutting tools. While this solved the problem for turning tools that could be easily reground, the difficulty was almost insurmountable in the case of twist drills, taps, and solid dies. The problem, in fact, became so serious that during 1926 and 1927 several of the large manufacturers of twist drills, taps, and dies experimented extensively on specially designed tools for high-chromium metal. However, in 1928, the Carpenter Steel Co. placed on the market a high-sulphur stainless steel made under the patent referred to, which changed the entire aspect of machining high-chromium alloys. This steel, known as Carpenter stainless steel No. 5, contained 0.10 per cent carbon, 14 per cent chromium, and 0.30 per cent sulphur.

This high-sulphur chromium iron can be machined in automatic screw machines with standard tools at speeds equal to, or closely approximating, those used for common Bessemer screw stock. This material can also be easily drilled, tapped, and threaded with dies. In fact, deep holes can be drilled in it with gun-barrel drills. The sulphur addition in this stainless steel also eliminated the difficulties caused by the high frictional quality of the material. Wire and tubing can be cold-drawn without using a metallic coating—simply using the lime coat and lubricants normally employed for ordinary steel.

The non-galling, non-seizing properties of this high-sulphur stainless iron has led to its wide adoption for mountings in gate valves, pump rods, and in a great variety of similar applications. One use for which it has become almost universally adopted is for golf club heads, because the cost of grinding and polishing is reduced approximately 50 per cent due to the free grinding properties of the metal.

One type of free-machining alloy being made is a chrome-nickel stainless steel containing 18 per cent chromium and 8 per cent nickel, known by the trade name, Carpenter stainless steel No. 8. Chrome-nickel steels of this composition, low in sulphur, not only possess high frictional properties, but are also extremely difficult to machine, because of their structure and great toughness. For many years they were considered almost impossible to machine. By using a high-sulphur metal of the same composition, free-machining properties are obtained.

Some interesting tests have been made on these new stainless steels. Similar operations were performed in a bolt and nut factory on Carpenter stainless steel No. 4 and Carpenter stainless steel No. 8, which have the same chromium and nickel content, the only difference being that No. 4 is low in sulphur, and No. 8 high.

On a four-spindle Gridley automatic, drilling and cutting-off standard nuts from a 5/8-inch cold-drawn hexagon bar, the highest speed obtained on the non-free-cutting steel was 120 surface feet per minute. It took 20 seconds to finish one nut. This speed was found excessive, however, since the tooling began to break down after completing twelve nuts. The new No. 8 steel was run at a surface speed of 150 feet per minute with increased feed. It completed a nut every 10 seconds without any indication of damage to the tools. Assuming the normal production of high-sulphur Bessemer screw stock as 100, the production on the No. 4 stainless steel grade was 75; and compared to S A E 3135, the production on the No. 8 stainless steel was 125.

On a power hacksaw, cuts on the non-free-ma-

chining metal required 1 minute 20 seconds, as against 30 seconds for the free-machining type of metal.

A further comparison of the machineability was made on a National nut tapping machine using a bent-shank tapper tap. It was found impossible to tap the non-free-cutting steel on this machine, as the second nut would jam the tool. The free-cutting steel could be tapped at the rate of 2.5 seconds per nut. The tap was made of carbon tool steel, 7/16 inch in diameter, with 20 threads per inch.

A comparison between the two grades was also made with a standard high-speed twist drill. A 1/4-inch hole was drilled. Under normal conditions it was possible to drill the free-machining No. 8 grade 1 1/16 inches deep in 28 seconds. The No. 4 non-free-cutting grade ruined the drill at a depth of 3/8 inch after 20 seconds of cutting.

The corrosion resistance of these high-sulphur steels is about the same as that of the low-sulphur types. At present it is general practice to use the non-free-machining types for parts that are brought to shape by bending, forming, or drawing, and to use the free-machining grades for parts that are to be machined.

* * *

The "Electric Eye" Opens Garage Doors

The "electric eye" has a new task at the Albany, N. Y., service building of the New York Power and Light Corporation. It opens garage doors after the cover of darkness has fallen. Only the beam of an automobile headlight is necessary to have the door swing wide open, automatically and magically.

A hole, about an inch and a half in diameter, has been drilled in the door and a protective glass covering placed over it. On the inside is a metal tube containing a General Electric photo-electric tube, and from this tube wires lead to the amplifying device attached to the wall of the garage that operates the doors. The beam of the headlight on the glass window, strikes the light-sensitive surface of the photo-electric tube to a degree sufficient to actuate a relay which operates the regular electric door opening mechanism. Push-button switches operate the electric door opener during the day.

Automatic Blueprinting Machines Meet Production Requirements

Industrial plants which require the issuing of hundreds of blueprints daily to the shop, find it profitable to make the blueprints in machines that automatically carry the prints through the various stages of the process. The illustration shows a Pease Model 20 continuous type machine installed at the American-La France & Foamite Corporation, Elmira, N. Y.

Tracings are fed into the front of the machine on a continuous roll of sensitized blueprint paper. After exposures have been made under a bank of high-power arc lamps, the tracings are returned to a tray at the front of the machine, while the exposed blueprint paper passes through the subsequent operations of washing, potashing, rinsing, and drying. The blueprinted paper is then automatically rolled up at the rear of the machine ready for cutting and trimming the various prints.

A Modern Blueprinting Department

Printing speeds of from 4 inches to 6 feet per minute are available so that the operator may choose the most suitable speed for the different kinds of tracings.

* * *

The railroads and interurban electric lines, long content with their traditional speed, have lately been urged to investigate the possibility of faster runs by the performance of automobiles and airplanes. One of the greatest difficulties, it has always been supposed, was that very high speeds, because of air resistance, would demand inordinately great power and consequently would become very expensive. Dr. Tietjens of the Westinghouse Research Laboratories at East Pittsburgh, Pa., by applying experience gained in aviation aero-dynamics, has proved that this is not so. Railway cars can be run at 100 or even 150 miles per hour with very reasonable power, provided they are streamlined. Tests of models in a wind tunnel indicate that such streamlining will save half the power needed by a six-car railroad train running 140 miles an hour. Properly streamlined interurban cars can run 100 miles an hour, using only one-half the power required by an ordinary car running at the same speed.

Maintaining and Repairing Motors

The Operating Costs for Motors Can be Lowered Materially by Systematic Inspection and the Application of Proper Methods of Reconditioning

By R. H. PARRISH, Electrical Engineer
Power Cost Engineering Co.
San Antonio, Texas

THE old saying "An ounce of prevention is worth a pound of cure" could not be more accurately applied than in the case of electric motor maintenance and repair. It also applies equally well to allied equipment. Lately an engineer in charge of quite a large plant, consisting chiefly of motor-driven pumping equipment, said to the writer, "What would be your recommendations as to ways of keeping an accurate check on the condition of equipment in my plant so as to keep our repair and maintenance cost at a minimum?". The following is an attempt to answer this most vital question in the language of the average plant engineer or superintendent. The methods recommended will pay well in preventing costly troubles, and what is likely to be even more desirable, they will prevent interruption of service.

Instruments Required for Testing Motors

The instruments most needed are the voltmeter, ammeter, and megger, with ranges and characteristics suitable for the motors to be tested. If alternating-current and direct-current measurements are to be made, there is a voltmeter on the market that can be used for both, which has a scale range of 150 to 600 volts. If a voltage of 2200 or higher is employed, a potential transformer is used with the proper voltage ratio to bring the secondary voltage down to that of the voltmeter. The handiest ammeter is one that works in connection with a split-core transformer, which clamps over the motor lead. With this type of transformer, the reading on the ammeter can be multiplied any number of times by merely passing the motor lead through the transformer the required number of times, the reading being multiplied exactly as many times as it is passed through.

Motors Should be Tested Once a Month

Testing the motors once a month is sufficient under normal conditions. This inspection should include a test with a megger to determine the condition of the insulation—that is, whether it is moisture-soaked, oil-soaked, weakened or punctured in spots due to high voltage or overloads; a test for grounds; and a test for short circuits and open circuits. The rotor clearance should be accurately tested at the top and bottom, and at both sides. This can best be done with a regular set of rotor clearance gages. By testing for bearing wear in this way, a costly burn-out due to the rotor swiping the stator can be prevented. It is far better to spend a few dollars on bearings than a few hundred dollars on new windings.

The standard 40 degree C. rated motor should not be permitted to operate where a test shows that it is pulling a line current in excess of 10 per cent of the full load current stamped on the nameplate. Neither is it advisable to operate a motor that is very lightly loaded, for the reason that its efficiency decreases with the decrease in load below the normal rating, the decrease being especially noticeable when the load is below 75 per cent of the normal capacity. The thing to do in such cases is to replace the motor with a smaller one. When there is a large number of motors in a plant, this exchange can be made with but little trouble and expense. In like manner, overloaded motors can be exchanged for larger ones.

There are many causes for overloaded motors, the most common of which are the selection of a motor too small for the load; unbalanced voltage; low voltage; one phase out due to a blown fuse or burned-out coil; improper brush contact; or loose rotor bars. Often the trouble is in the driven machine, and it is assumed that it is in the motor, possibly because the operation of either the machine or motor is not clearly understood.

Examination for Mechanical Faults

Couplings on direct-connected units should be examined for loose or worn bolts and misalignment. Gears and pulleys should be examined for worn or broken teeth and looseness on the shaft. Proper alignment of flat belts is highly important, for if the belt runs off on the outside edge of the pulley, it causes abnormal torque or pull on the shaft and bearings; and if it runs off on the inside of the pulley, it will wear rapidly and cause vibration, as well as an increase in the friction load.

Methods of Insuring Proper Lubrication

The lubricating oil recommended by the manufacturer of the individual motor or machine should be used to excess rather than too sparingly, for when lubrication is neglected, the maintenance bills go up. In the case of electric motor lubrication, however, special care must be taken to prevent oil from reaching the windings or brush and the starting mechanism, especially on smaller motors. Oil on rubber or insulation fabrics is undesirable from the viewpoint of economy, as it has a deteriorating effect upon them. Oiling systems should be given close inspection, and oil gages should be replaced if damaged or broken. Missing covers should also be replaced.

All oil-ring inspection cups should have lids or covers, and where it is intended that felt gaskets

be used, they should be kept in their proper places to prevent the least bit of dirt, dust, or other abrasive matter from entering the oil chamber. Missing covers on end bells should be replaced. Felt washers around shafts should be kept pliable and should be replaced if not in good condition. Oil-rings must be kept revolving freely; this should be checked each time the motor is started if it is a large one, and at frequent periods in the case of small motors.

Points on Avoiding Trouble in Overhauling Motors

In overhauling motors, it is generally a good plan to make a sketch showing the arrangement of leads, preferably tagging all wires that might be reconnected incorrectly. Put a punch or chisel mark on the end bell and frame to insure correct replacement. Also, while doing the overhauling, it is well to remember that it is better to do one thing right at a time than to make too much speed and later find that the whole thing must be torn down to locate trouble that could have been avoided.

Further, motors should be dismantled carefully, noting the condition of all parts as to defects or wear. They should be carefully examined for possible defects, such as bad insulation, grounds, shorts, open circuits, loose bars in the commutator or rotor, bad brush contact, and faulty brush-holder or throw-out device. By making these more or less simple, inexpensive tests and examinations, one is using the best known means for reducing the upkeep cost.

One of the most vital things as regards motor maintenance is proper care and inspection of motor bearings. If found to be worn, they should be replaced with new or rebabbitted ones. Bearing wear can best be detected by measuring rotor clearance with a clearance gage or by lifting up and down on the pulley end with the hands and listening for a "squashing" sound, which may be detected if there is any play in the bearing. In inspecting the bearings of a large motor, the existence of play can be determined by prying up under the pulley with a bar or timber.

Before making new sleeve bearings, it is best to see if there is any looseness between the shaft and the rotor. Also, the rotor should be placed on centers in a lathe and checked for trueness. Shafts are generally press fits, and if found loose, must be removed and turned down in the lathe to a press fit in the bore of a new bushing fitted in the rotor. If the shaft is bent, it is possible that it can be straightened satisfactorily and trued up in the lathe, but usually it is best to put in a new shaft. After the rotor is trued up and the rough or pitted spots turned or ground down on the journal, it is time to put in new bearings.

While the rotor is in the lathe, a light cut should be made on the commutator to insure its running true when placed back in use. In the case of a squirrel-cage motor, the rotor must be checked for loose rotor bars, and if any are found, they are best secured by brazing. After brazing, the rotor should be put in a lathe for turning the bars slightly below the rotor laminations. At this point the mica should be under-cut and the rotor then dipped or painted, and baked well.

For reconditioning a stator that does not need rewinding, a thorough cleaning with high-test gasoline, using an air cleaning gun with low-velocity air, is advisable. For damp windings, a good baking followed by one or more coats of baking varnish or good air-drying insulating varnish is recommended. Before the motor is assembled, it should be given a thorough megger test and painted with a good grade of paint, preferably a color that shows dirt and that dries with a hard glossy finish. The motor is now ready for assembly and use.

Too often those in charge of the upkeep of costly equipment "just let it ride" until it fails on the job before any sort of repair or maintenance is given it. It is with this in mind that this article has been written. The information given, it is hoped, will make clearer what precautions, or really "preventive medicine," can mean to those paying the bills for motor maintenance, and will show how low the cost of this preventive medicine is in relation to the actual repair bill.

Air-Brakes on Machine Tools

Among the unusual developments in the machinery field are air-brakes for machine tools. Compressed air has long been a useful medium for actuating portable tools, such as drills and hammers, and for operating pneumatic hoists. During more recent years it has been applied to the operation of chucks. In one plant, the engineers have gone a step further than most designers and have adopted air-operated brakes on machine tools. These brakes enable a machine to be stopped instantaneously. By the use of reversing-type motors and air-operated brakes, the rotation of the work-spindle can be immediately reversed. An article describing in detail the design and construction of these brakes will be published in March MACHINERY.

* * *

Work Started on 1931 Census of Manufactures

The Census Bureau is now mailing its 1931 Census of Manufactures questionnaires to all manufacturers, with the urgent request that they be filled out and returned promptly. The value of statistics on manufactures is dependent largely upon their timeliness, and manufacturers can greatly assist the Bureau by returning their reports promptly. This, in turn, will make the census available to manufacturers at an early date.

It is essential that products be reported according to the classifications on the questionnaires. In the cases of some important industries, it is necessary to call for data in considerable detail in order to enable the Bureau to publish statistics that will be of practical value to the industries concerned.

Revised Book on Mechanical Drawing

MECHANICAL DRAWING (Second Edition). By Franklin D. Jones. 342 pages, 6 by 9 inches; 175 illustrations. Published by THE INDUSTRIAL PRESS, 140-148 Lafayette St., New York City. Price, $3.

This book is a treatise on the drawing of mechanisms and machine details, and covers comprehensively the making of different classes of drawings; the dimensioning, reading, and checking of working drawings; numbering and filing systems for drawings, and general drafting-room practice.

Many books on mechanical drawing have covered such subjects as geometrical drawing problems, orthographic projection, the development of intersecting surfaces, etc., but the application of these principles and the real object of mechanical drawing as related to machine and tool manufacture have often been dealt with vaguely. The student has been taught certain details, but he has not been given a clear conception of the work of draftsmen and designers in the drafting-rooms of machine-building plants. This book presents the subject in a way that will enable the student to understand what the term "mechanical drawing" really means in its broadest sense, the essential features of modern drafting practice, and the difference between the mere representation of a design by a suitable drawing and the more valuable work of originating and developing the design.

In arrangement and scope, this book is based on the assumption that it is essential for the student of mechanical drawing—whether in the school or in the shop—to understand the purpose of drawings as applied to machine and tool construction, how various mechanical devices may be represented by means of drawings, the necessity of making drawings that completely and clearly show what they are supposed to show, and the relation between *drawing* and *designing*. Special attention has been given to the dimensioning of drawings, and the importance of using printed instructions to make a drawing entirely clear is emphasized.

In dealing with the numerous details of the draftsman's work, an effort has been made to present methods that are sanctioned by common usage and to explain the reasons for the more important variations in practice.

The comprehensive scope of the work will be understood from the chapter headings: Drawings and Their Use in Machine and Tool Construction; Projection as Applied to Mechanical Drawing; Mechanical Drawing Instruments and Materials; How Designs are Originated, and Procedure to Follow in Making Drawings; Sectional Views and Reading of Drawings; Methods of Dimensioning Working Drawings; Instructions on Working Drawings and Procedure when Checking; Printing Processes and Apparatus for Printing, Washing, and Drying; Engineering Standards and Drawings of Machine Details; Designing or Laying Out Cams; Geometrical Drawing Problems and the Development of Intersecting Surfaces; Drafting-room Systems, Equipment, and Arrangement; and Sketching and Perspective Drawing.

Do You Know

that arc welding has now become such a standardized shop operation that one company has erected a plant several hundred feet long for arc-welding operations alone?—see page 401.

whether short-center flat-belt drives are practicable?—see page 432.

how to obtain the best results in silver soldering?—see page 430.

what equipment is required for an industrial X-ray laboratory?—see page 408.

how to test and record the performance of small tools?—see page 426.

to what extent printed notices on order forms affect the validity of the written purchase order?—see page 448.

that ten-foot tanks are now being arc welded to withstand pressures of hot oil up to 300 pounds per square inch?—see page 402.

what formula has been found most convenient for finding the minimum center distances for cross-belt drives?—see page 436.

whether depreciation should be calculated on the purchase price of a machine or on its replacement cost?—page 441.

New Shop Equipment

Latest Developments in Machine Tools, Unit Mechanisms, Machine Parts and Material Handling Appliances

Pratt & Whitney Hydraulic Vertical Surface Grinder

Hydraulic power actuates the table and the wheel feed of a 26-inch heavy-duty vertical surface grinder now being introduced on the market by the Pratt & Whitney Co., Hartford, Conn. Without the motors, this machine weighs 18 tons. In general design, it follows the 22-inch vertical surface grinder which it replaces. The added hydraulic features and other refinements in design have increased its speed and efficiency.

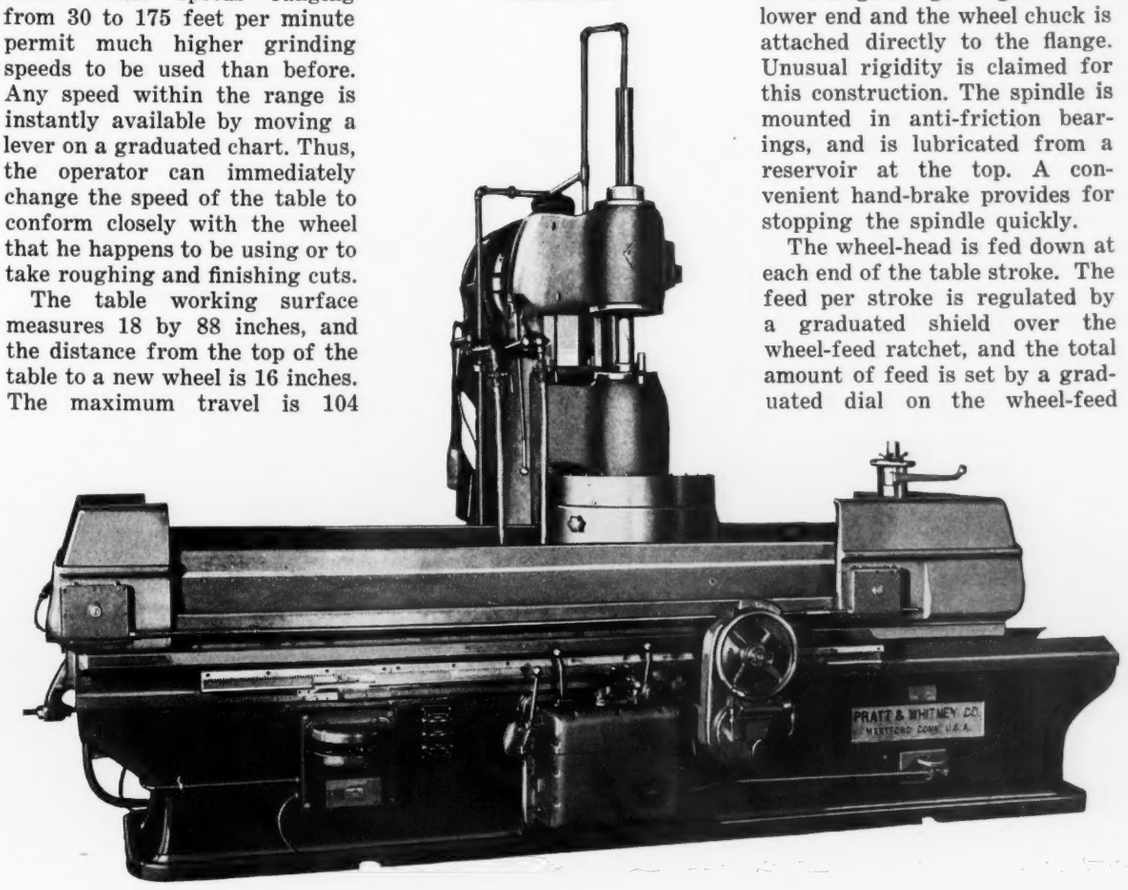
The hydraulic mechanism with its 10-horsepower motor is back of the bed, but all controls are in front. Table speeds ranging from 30 to 175 feet per minute permit much higher grinding speeds to be used than before. Any speed within the range is instantly available by moving a lever on a graduated chart. Thus, the operator can immediately change the speed of the table to conform closely with the wheel that he happens to be using or to take roughing and finishing cuts.

The table working surface measures 18 by 88 inches, and the distance from the top of the table to a new wheel is 16 inches. The maximum travel is 104 inches, the length of stroke being controlled by easily adjustable dogs of the rack and pawl type. The table can be reversed by hand at any time within the limit of the dogs. By tripping a latch, the table is brought out to the loading position and stopped automatically. The front water guard can be raised or lowered quickly by means of a lever. A graduated wheel dresser is mounted on the end guard of the table. It is swung out of the way when not in use.

The grinding-wheel spindle is driven through spiral-bevel gears by a 75-horsepower motor running at a constant speed of 1150 revolutions per minute, providing a spindle speed of 750 revolutions per minute. The spindle has a large flange forged on the lower end and the wheel chuck is attached directly to the flange. Unusual rigidity is claimed for this construction. The spindle is mounted in anti-friction bearings, and is lubricated from a reservoir at the top. A convenient hand-brake provides for stopping the spindle quickly.

The wheel-head is fed down at each end of the table stroke. The feed per stroke is regulated by a graduated shield over the wheel-feed ratchet, and the total amount of feed is set by a graduated dial on the wheel-feed

Pratt & Whitney Vertical Surface Grinder with Hydraulically Operated Table and Wheel Feed



handwheel. Although the wheel feed is operated hydraulically, it can be operated by a handwheel if desired. Power feeds ranging from 0.00025 to 0.005 inch are available. Segmental grinding wheels are used. The heavy wheel guard is so arranged that the segments can be easily adjusted or removed.

Coolant is supplied from a 350-gallon tank. A pump driven by a two-horsepower motor delivers the coolant through the wheel-spindle and also through a pipe line to the outside of the wheel. An additional line supplies water for washing off the chuck. The coolant supply is controlled by a lever conveniently located. All three motors of the machine are controlled from a push-button station at the front of the bed.

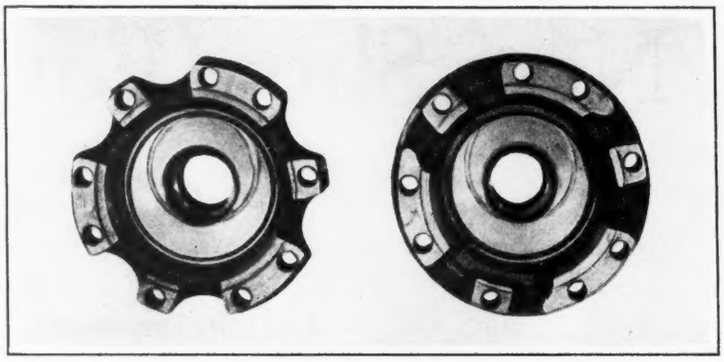


Fig. 2. Parts Burnished and Grooved in the Machine Shown in Fig. 1

Rockford Face Burnishing and Grooving Machine

Hydraulic power is employed both for indexing the work fixture and feeding the tool-head in a machine recently built by the Rockford Drilling Machine Co., 209 Catherine St., Rockford, Ill. This machine, which is shown in Fig. 1, burnishes the face around the bore of the parts illustrated in Fig. 2, and also cuts a groove in this face. The automatic operation of the machine reduces the operator's work to merely loading and unloading the parts.

Two parts are loaded and unloaded at a time in the idle stations of the machine. At the same time, the oil-groove is cut in two parts at the first working station, and two other parts, which have previously been grooved, are burnished at the second working station. In operation, the machine head feeds forward to cut the groove, builds up pressure for the burnishing, and then returns to the starting position. The fixture drum automatically indexes one station at a time and locates the head accurately for each cycle. The machine operates continuously until stopped. A seven-second cycle is possible, although the cycle may be slowed up to suit the speed of the operator. Stopping can be effected quickly at any point in the cycle.

The hydraulic operation of this equipment is effected by an Oilgear pump. A 7 1/2-horsepower motor drives the four spindles of the machine head through gearing. These spindles are mounted in Timken tapered roller bearings. The grooving and burnishing tools are guided accurately by bushings held in a bracket mounted on the machine base. All working parts in the head, the ways of the machine, and the guide bushings are automatically lubricated. The indexing fixture is also mounted in Timken bearings. Machines of this type can be built in various sizes to suit specific requirements.

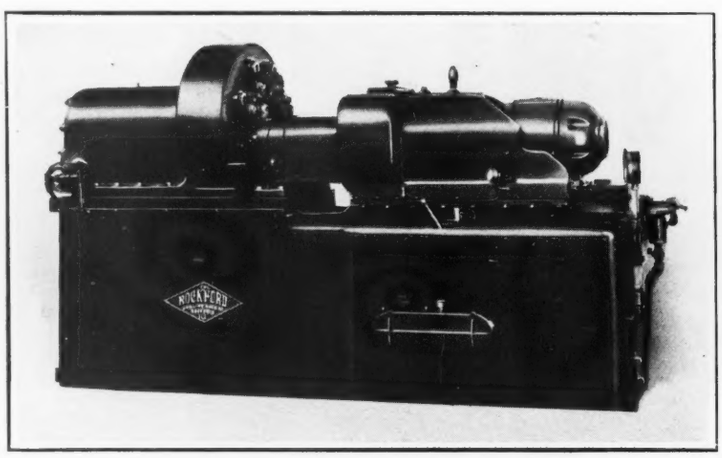
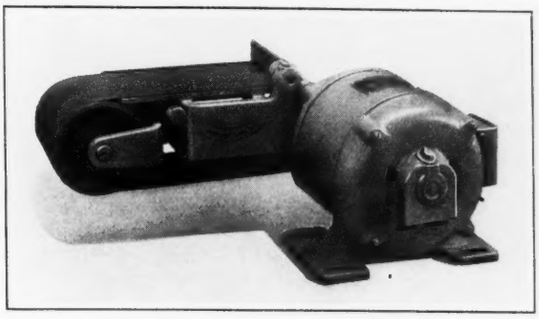


Fig. 1. Rockford Burnishing and Grooving Machine with Hydraulic Indexing and Feeding Features

Self-Contained Abrasive-Belt Surfacer and Polisher

The bench type abrasive-belt surfacer and polisher here illustrated is a recent development of the Production Machine Co., Greenfield, Mass. It consists of an abrasive unit mounted directly on a motor. Electric current for driving the motor can be taken from a lighting socket.

This machine is intended for such operations on tools, dies, stampings, etc., as surfacing, burr-removing, squaring up, straightening, smoothing, and polishing, as well as for cleaning castings. It can also be used in woodworking shops. The pulleys are 4 inches in diameter by 4 1/2



Bench Type Abrasive-belt Surfacer and Polisher Made by the Production Machine Co.

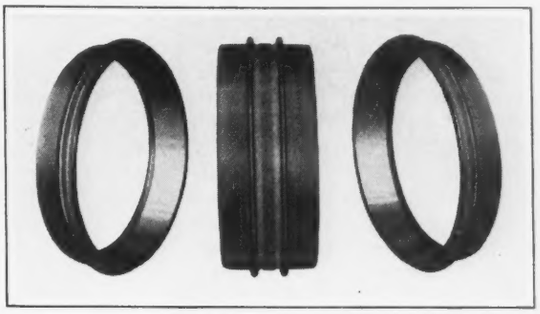


Fig. 2. Two Brake-drums and a Section Like the One from which They have been Split

inches face width. The work-table is 7 1/2 inches long, while the abrasive belt is 35 inches long by 4 inches wide. The abrasive belt is made endless with a patented joint.

Sundstrand Brake-Drum Splitting Machine

Among the more recent developments in automotive construction is the cast-iron or special-alloy brake-drum. One manufacturer makes these brake-drums by casting the alloy iron centrifugally into a rolled-steel shell of double width. In producing these shells, the steel is cut off to length and rolled into a circular form, after which the ends are electrically welded together. After the alloy iron has been cast centrifugally into it, the rolled section is split to produce two brake-drums.

One of these double sections is shown at the center of Fig. 2 before it has been split, and two drums produced from such a section are shown at each side of it. By using double-width sections, a symmetrical section can easily be rolled, and the flanged edges retain the molten metal during the centrifugal casting process.

The splitting or parting of the double shell presented somewhat of a problem, because the tools are required to cut first through the steel shell, then through the weld or bond, and finally through the cast alloy iron. It was to handle this operation that the Sundstrand Machine Tool Co., Rockford, Ill., developed the machine shown in Fig. 1. This machine is equipped with front and rear cut-off slides. Two tools are mounted on each slide. In each case, one tool is mounted directly over the other, the top tool being set slightly in advance of the bottom tool, as the latter is used to finish the sides of the drum halves. The rear slide is set in advance of the front slide an amount equal to one-half the feed per revolution.

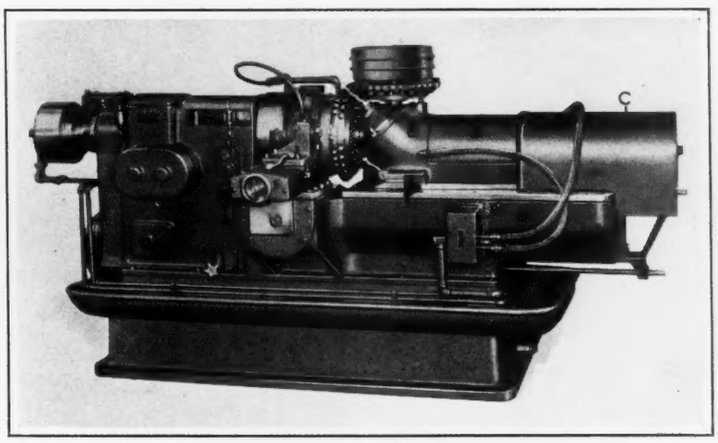


Fig. 1. Sundstrand Machine for Splitting Two Brake-drums from Steel Shells in which Iron has been Cast Centrifugally

Fig. 1 illustrates the machine with the cut-off slides in the forward position. After a drum has been split, the slides are ready to return automatically at a rapid rate to their loading positions. This movement of the slides automatically releases the air in the line to the chuck on the headstock and causes the chuck to open. At the same time, the movement of the chuck draw-rod automatically operates a limit switch and causes the spindle to stop.

When the cut-off slides have fully returned, valve *D* is operated automatically, causing the turret-slide *A* to return to its extreme right-hand position under cover *C*. In this position, turret *B* automatically indexes 180 degrees to bring the split brake-drum halves into the unloading position and to carry another double brake-drum into the chucking position. The operator then again actuates valve *D*, causing the turret-slide to advance and place the double brake-drum in the chuck jaws, where it is automatically gripped. The operation of valve *D* also automatically starts the spindle and the advance of the cut-off slides. These slides move first at

a rapid traverse rate and then at a slower feeding rate.

The automatic loading arrangement greatly reduces the physical effort of the operator, which is important, as the double brake-drums weigh approximately 27 pounds. In loading either work-carrier, the operator turns a knurled ring, which causes a three-jaw scroll chuck to grip the work piece for the full length from the inside. Thus, after the parting tools have split the drum into two, both halves are held securely and returned by the carrier into the unloading position. The headstock chuck grips the double brake-drum from the outside.

Gleason Spiral-Bevel Pinion Burnisher

A machine designed for burnishing spiral-bevel pinions is being placed on the market by the Gleason Works, 1000 University Ave., Rochester, N. Y. In construction, this machine follows closely the 18-inch combination gear testing and lapping machine described in November, 1930, MACHINERY, page 233. It is provided with an adjustment that permits the burnishing operation to be concentrated on either the toe or heel of the pinion teeth if it is desired to change the location of the tooth bearing. One of the features of the machine is that it only smooths up the profile and cannot change it, with the possibility of causing inaccuracies.

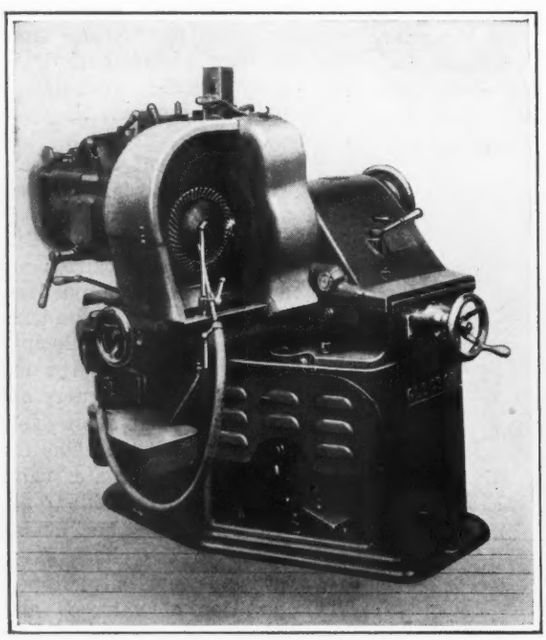
The burnishing operation consists of running a "soft" pinion in mesh with a hardened mating gear, in order to smooth out any cutter marks on the pinion teeth. The machine is not intended to compensate for poor gear-cutting. It is based on the principle of holding the gear and pinion in proper contact under pressure, and instead of the rocking motion formerly used in burnishing, the teeth are given a slight movement lengthwise of the face.

The relative motion between the gear and pinion is obtained in the same manner as the lapping motion in the lapping machine. The pinion drives the gear, and as the two rotate, the position of the gear is changed continuously and automatically to effect a combined horizontal and vertical movement of the gear in relation to the pinion. As the position of the gear changes, the pinion moves in and out with the gear, resulting in an in-and-out movement of the pinion with reference to the gear axis.

If desired, the machine can be equipped with several time-saving features, including automatic chucking and "dechucking" of both the gear and pinion, and an in-and-out movement of the pinion head that facilitates reloading. The spindle on which the pinion is mounted can be run in either direction. The driven head is adjustable to suit the burnishing of hypoid gears. An adjustable backlash brake maintains an even load on the spindle.

Fellows "Hourglass Worm" Thread Generator

A thread-generating machine particularly adapted for cutting the so-called "hourglass type" worms that are used extensively in automotive steering gears has been placed on the market by the



Burnishing Machine for Spiral-Bevel Pinions Made by the Gleason Works

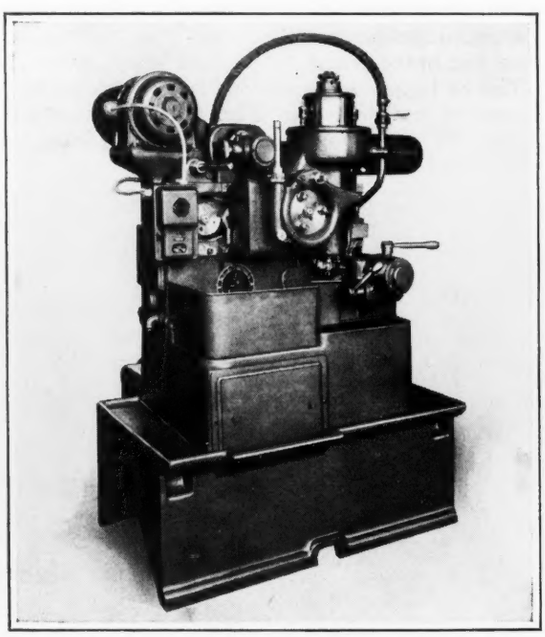


Fig. 1. Fellows Generator for Cutting the Thread of "Hourglass" Worms

Fellows Gear Shaper Co., Springfield, Vt. These "hourglass" worms operate either with a helical gear segment, as shown in Fig. 2, or with a rack-tooth shaped cylindrical roller. The mating helical-tooth segment can be generated on the Fellows high-speed gear shaper.

The thread-generating machine, which is shown in Fig. 1, presents an especially rapid means of cutting worms of the type mentioned. As an illustration, a single-thread "hourglass" worm of 4.268 inches diametral pitch can be completed in two minutes or less floor-to-floor time, using a 13-tooth cutter of 3.046 inches pitch diameter. The actual cutting time is 45 seconds for roughing and the same for finishing.

Another important feature of the machine is the side-trimming mechanism. This mechanism provides positive control over thread proportions in that, with the work and cutter set at the standard center distance, the cutter can be oscillated the required amount each side of its central position to cut the thread to the desired proportions. This feature also greatly prolongs the useful life of the cutter.

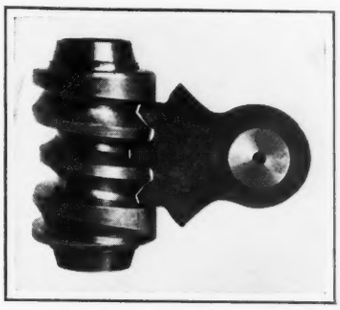


Fig. 2. "Hourglass" Worm and Sector Used in Automotive Steering Gears

The work is mounted on an arbor that is held at one end by the work-spindle and at the other end by a female "live center." The cutter is positioned at right angles to the work, and is fed to the required depth by a cam as the work and cutter rotate in mesh with each other. There is no lateral motion of the work, but the cutter, especially for finishing, oscillates while it is being fed. For best results, the roughing cut should be taken in one machine, and the finishing cut in another machine.

The cutter-spindle is adjustable for height by means of a micrometer nut and a locking nut. The work always rotates in a clockwise direction, but the rotation of the cutter can be changed to suit right- or left-hand threads. The machine stops automatically when the operation has been completed.

Avey Special Drilling and Tapping Machines

Drilling and tapping machines recently built by the Avey Drilling Machine Co., Inc., Cincinnati, Ohio, for operations on automotive cylinder blocks and head liners are shown in Figs. 1, 2, and 3. While these machines are of special design, standard Avey motor units are used in their construction.

The cylinder-block machines shown in Figs. 1 and 2 are electrically controlled from the front. A "telltale" light shows when the tools have cleared the work. Air is used as a "booster" to provide

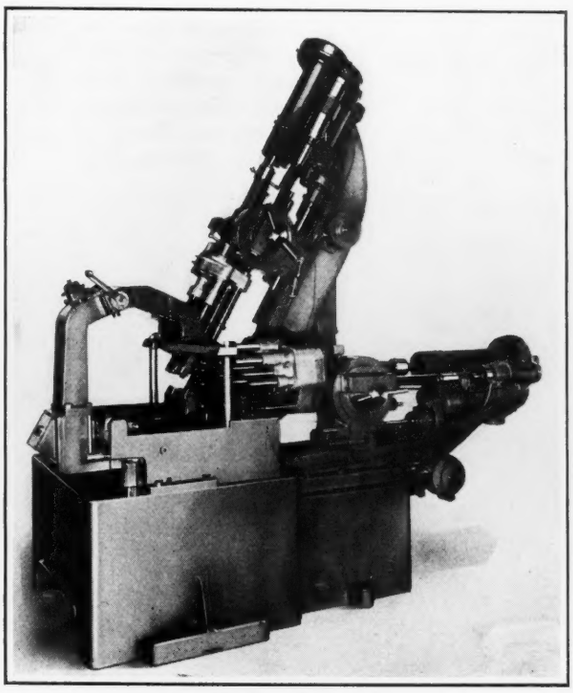


Fig. 1. Special Drilling and Tapping Machine with Standard Avey Motor Units

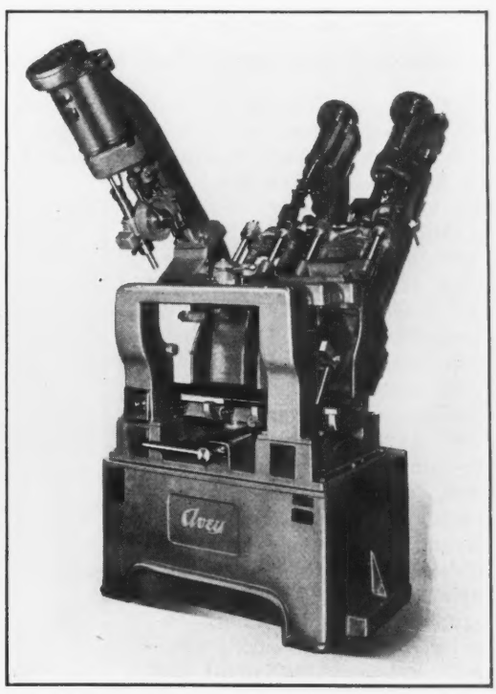


Fig. 2. Another Special Drilling and Tapping Machine for Automotive Cylinder Blocks

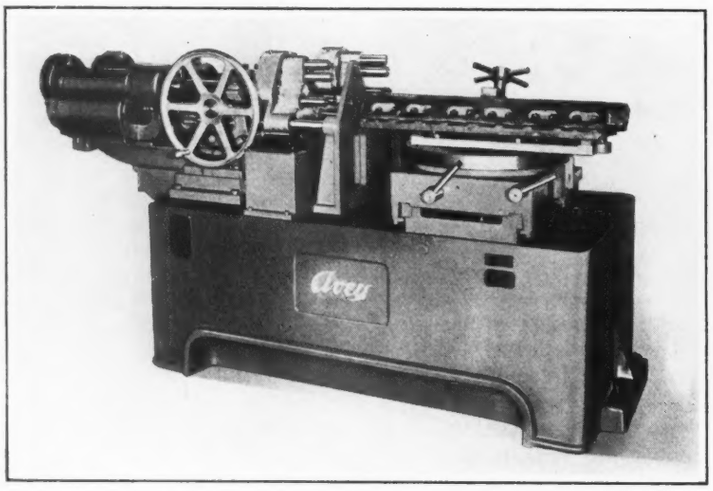


Fig. 3. Horizontal Machine for Drilling and Tapping Both Ends of Cylinder Heads

a quick advance to the spindles. The cylinder blocks pass through these machines from left to right on rollers. Disappearing locators are used when the blocks are passed through in their normal position, but when inverted, they are raised on permanent locators at the top of the fixture.

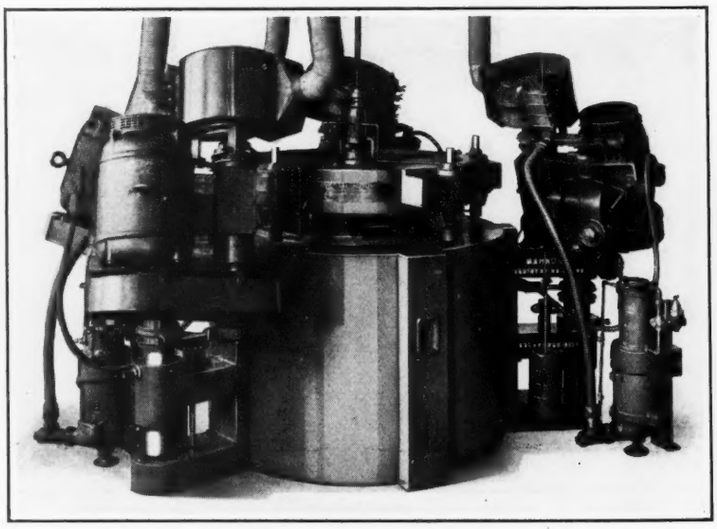
The machine shown in Fig. 3 drills and taps water connection holes in both ends of straight-eight and twelve-cylinder V-type heads. The front unit drills, and the rear unit taps, the holding fixture being provided with both sliding and rotary movements. The extra spindles of the multiple heads are used for cylinder heads having holes located differently from those of the head that is shown on the machine.

Hammond Automatic Polishing and Buffing Machine

The latest addition to the line of universal rotary automatic polishing and buffing machines manufactured by Hammond Machinery Builders, Inc., Kalamazoo, Mich., is shown in the accompanying illustration. Earlier models of this line of machines were described in May, 1931, MACHINERY, page 714. These machines can now be obtained in both single-purpose, or single-operation, and general-purpose, or universal, types. Although a four-spindle machine is illustrated, six- and seven-spindle models are also built.

Round, flat, or beveled work can be polished by the use of simple adapters. The table can be supplied with indexing, continuous, or reciprocating motions, or a combination of the three. The polishing and buffing heads are motor-driven through multi-V belts. Their speeds can be varied either by using sheaves of different diameters or by the use of the Hammond variable-speed V-pulley, which permits speeds up to 50 per cent of the low speed to be employed. The spindles have a self-contained oscillating arrangement which can be engaged or disengaged through a lever on the outside of the housing.

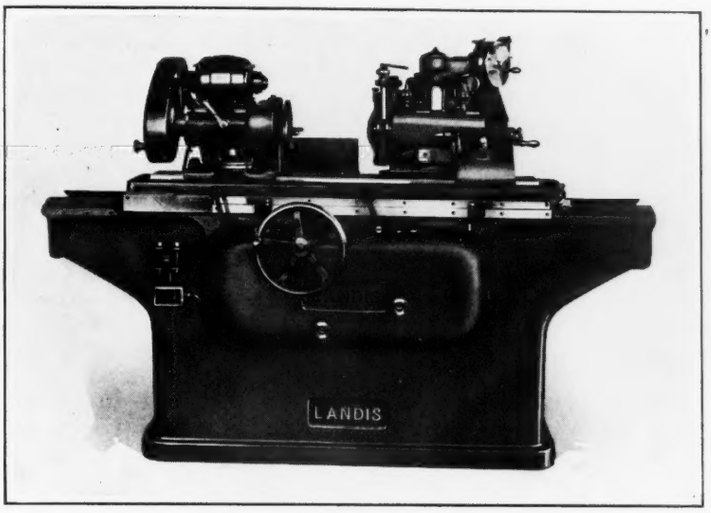
Automatic devices feed composition paste to the polishing and buffing wheels by means of compressed air. The centrifugal force of the wheel carries the composition to a fabric collector pad, clamped to one side of a distributing nozzle. The pad is in contact with the wheel, and thus applies a definite film of the composition, either constantly or intermittently, as preferred. For intermittent feeding, a hand or foot control is supplied.



Hammond Automatic Polishing and Buffing Machine

"Purox" Regulators

The Linde Air Products Co., 30 E. 42nd St., New York City, has recently brought out a series of improved "Purox" oxygen and acetylene regulators which supersedes the former line of "Metal Master" regulators. One of the features of the new regulators is a self-aligning valve of the nozzle and yoke type, which insures sensitive action and freedom from leakage. The working pressure gages are 2 inches in diameter, and the cylinder pressure gages are 2 1/2 inches in diameter.



Landis Universal Grinder with Hydraulic Table Traverse at Speeds Ranging from 6 to 144 Inches per Minute

Landis Hydraulic Universal Grinder

A universal grinding machine designed to handle a great variety of the lighter production jobs, and tool-room work as well, has been added to the line of hydraulically operated grinders built by the Landis Tool Co., Waynesboro, Pa. The hydraulic table traverse of this 10- by 24-inch machine enables table speeds of from 6 to 144 inches per minute to be used. Ease of operation, due to a convenient arrangement of the controls, is another feature. All mechanisms are readily accessible for inspection or adjustment.

The hydraulic system consists of twin cylinders and a Tuthill internal-geared oil-pump. One of the cylinders is used for moving the table in one direction, and the other for moving it in the reverse direction. The volume of oil in the cylinders is constant, regardless of the direction in which the table is traversed. A control valve at the front of the machine governs the flow of oil from the end of one cylinder to the corresponding end of the other cylinder. Reversal takes place through the medium of a piston-type valve.

The oil-pump is driven by a constant-speed motor. The motor is connected to the water-pump shaft by means of a flexible coupling. This shaft extends through the water pump and is coupled to the oil-pump shaft.

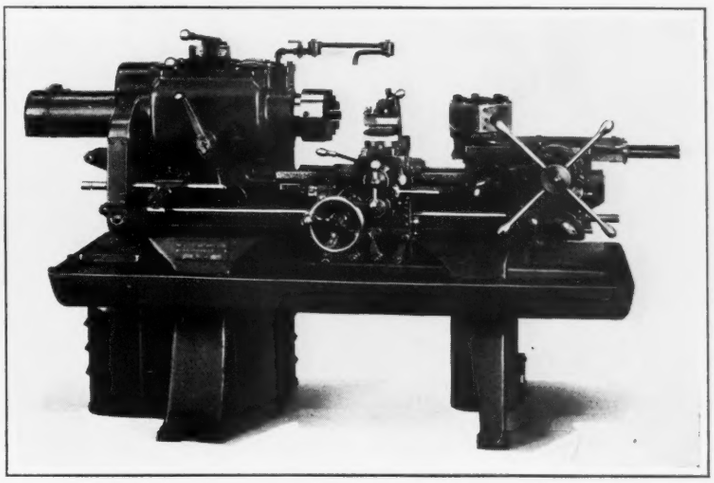
A plain wheel feed is standard equipment, but a hydraulic automatic wheel-feed mechanism can be supplied. This mechanism is operated by a small piston at the rear of the automatic feed-up handwheel, and functions at each reversal of the table.

The grinding-wheel spindle is driven by a 1 1/2-horsepower balanced motor at the right-hand end through a flat belt. The wheel-head can be swiveled on its slide to permit using the wheel at various angles without influencing the direction of the feeding movement. The wheel can be fed in different directions. Standard equipment includes both 10- and 12-inch wheels. A ball-bearing internal fixture is supplied for mounting on the front of the wheel-head.

The headstock is driven by an individual 1/3-horsepower constant-speed motor, controlled through a limit switch which is operated by means of a start-and-stop lever. A flat leather belt transmits the power from the motor to a jack-shaft at the front of the base. The power from the jack-shaft is delivered to the faceplate through another flat belt. Six work speeds are available by changing the pulleys and belts at the left-hand end of the headstock. The net weight of the machine without electric motors, but with all standard equipment, is 3890 pounds.

Warner & Swasey Universal Turret Lathe

The new No. 3 universal turret lathe, now being placed on the market by the Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio, has been designed with a view to increasing the productivity of the machine. It has a bar capacity of 1 1/2



Warner & Swasey New No. 3 Universal Turret Lathe

inches and a maximum swing of 15 3/8 inches. Six spindle speeds, ranging from 67 to 740 revolutions per minute, are quickly obtained through conveniently located levers. Forward and reverse rotation are available for all speeds. The spindle is mounted in double Timken roller bearings, both at the front and rear. The head-end gear train, which transmits power from the spindle to the feed-shaft, runs in an enclosed box and is splash-lubricated. The entire head runs in a bath of oil.

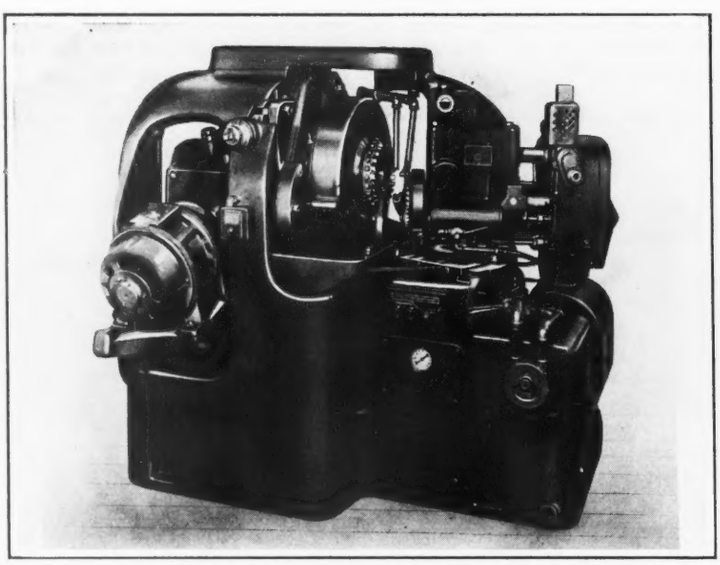
The hexagon turret is mounted on a Timken roller bearing. A nut provides for adjusting the turret to obtain the proper freedom of movement. Adjustments do not interfere with the permanent alignment of the turret with the center line of the spindle. Automatic indexing, together with an automatic binding mechanism, increases the convenience of turret operation. The backward movement of the slide automatically releases the turret clamp and indexes the turret, while the forward movement automatically clamps the turret in position. Six power feeds are provided for the hexagon turret.

The square-turret cross-slide has a long dovetail bearing surface, so constructed that it is not exposed to grit or chips in any working position. A plunger pump provides lubrication to all slide bearing surfaces. There are six power cross and longitudinal feeds, both forward and reverse, for the universal carriage. Six screws on the cross-slide carriage stop-roll facilitate the cutting of more than one diameter with one tool in the square turret.

Gleason Spiral-Bevel Gear Rougher

The No. 10 spiral-bevel gear rougher recently developed by the Gleason Works, 1000 University Ave., Rochester, N. Y., is similar in construction to the machine described in March, 1931, MACHINERY, page 544, but is designed for gears of smaller size. It has a capacity for cutting gears up to 5 1/2 inches in cone distance, of 8 to 1 ratio, 11 inches pitch diameter, and 3 diametral pitch.

The machine is claimed to rough-cut gears in less than one-half the time formerly required. This has been made possible by the use of higher feeds and speeds, and by reducing the chucking and unloading time. The time required for removing the rough-cut gear and replacing it with a blank has been reduced to the minimum, as the work is automatically "dechucked" and ejected at the end of the operation. The operator need only remove the gear from the work-spindle, put in a new blank, and turn a handle. The gear is then automatically chucked and moved into the cutting position by power.



Gleason Spiral-Bevel Gear Rougher in which 6-, 9- and 12-inch Cutters are Used

When the cut is taking place, the only movements are the rotation of the cutter-spindle, which is mounted in preloaded anti-friction bearings, and the feed movement of the cutter-spindle sleeve. No generating motion is employed, the tooth slots being cut by a simple depth-feed motion of the cutter into the work. After each slot is cut, the cutter is withdrawn to permit the work to be indexed.

The cutter-spindle is mounted in a saddle in the upright. The entire saddle assembly is adjustable, both horizontally and vertically, for setting the cutter to the proper spiral angle. The cutter is driven through an internal gear, bolted to the cutter-spindle faceplate. Change-gears provide various cutter speeds from 75 to 180 feet per minute. The "feed" or the time per tooth is hydraulically regulated. Any desired rate from 1 to 30 seconds per tooth is available.

The work-head is mounted directly on the frame of the machine. It has the usual angular and linear adjustments to accommodate gears of various pitch angles and cone distances. The work-spindle remains stationary during the operation, except when the work is indexed. Two clamps operate simultaneously and with equal tension to hold the spindle. When all the gear teeth have been roughed out, the work is automatically moved away from the cutter a sufficient distance to permit the roughed-out blank to be easily removed.

An automatic stop functions to stop the machine when the last tooth of a gear is cut. This device resets itself after each blank is roughed, and thus eliminates

any possibility of recutting a tooth. The stop is easily changed by means of a graduated dial to suit different numbers of teeth. Lubrication of the machine is accomplished automatically. The machine is arranged for using 6-, 9-, and 12-inch cutters. It has a weight of approximately 9500 pounds.

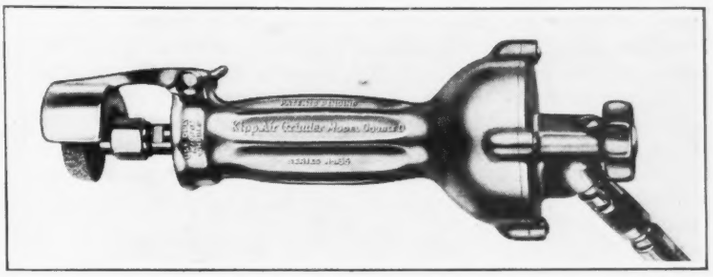


Fig. 1. Kipp High-speed Air Grinder for Wheels up to 1 1/2 Inches in Diameter

Starrett Micrometer with Carboloy-Faced Anvil and Spindle

A micrometer with Carboloy facings on the anvil and spindle is a new product of the L. S. Starrett Co., Athol, Mass. The advantage claimed for this micrometer is great durability, and this feature makes it especially suited for use on jobs where the anvil and spindle are subject to abrasive action.

This Carboloy-faced micrometer is equipped with a lock-nut and ratchet stop. The frame is cut away to facilitate its use in places where an ordinary micrometer cannot be employed. The micrometer is designated as "No. 230-X," and has a range of from 0 to 1 inch.

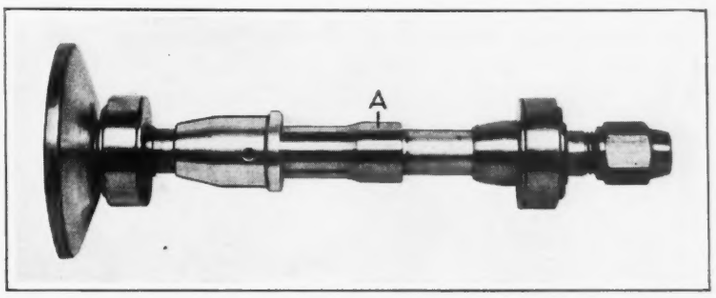


Fig. 2. View Showing the Steel Fingers that Automatically Hold the Speed at 30,000 Revolutions per Minute

Kipp "Miracle" Air Grinder

Grinding wheels up to 1 1/2 inches in diameter can be used on a "Miracle Double-D" one-hand grinder, which has been added to the line of air tools manufactured by the Madison-Kipp Corporation, 203 Waubesa St., Madison, Wis. This tool is small enough to be handy for die work, and yet large enough for comparatively heavy work. One of the main features of this grinder is the automatic speed control, by means of which the speed is automatically maintained at 30,000 revolutions per minute, regardless of variations in the pressure of the air line. The grinder, which is shown completely assembled in Fig. 1, weighs 2 1/2 pounds and is 9 3/4 inches long.

The automatic speed control is effected by means of a chrome-vanadium spring-steel part *A*, Fig. 2, which is slotted at one end to provide several fingers. These fingers, actuated by centrifugal force, automatically control the exhaust air ports in such a way as to maintain the correct air flow when the grinder has reached its established maximum speed of 30,000 revolutions per minute. This speed was determined by the manufacturer to be the most suitable for the tool.

Another feature of the grinder is the use of magnesium die-castings for the rotor and exhaust-valve cage. The lightness and balance of the rotor provide an unusually fast pick-up, eliminate vibration, and reduce the gyroscopic action produced when, under certain conditions, a mass revolves at high speed. Other die-cast members include the body and back-plate connector.

Oiling of the grinder is accomplished quickly by means of a Kipp syringe type of pressure oiler. This oiler is inserted into the collet end of the hollow spindle from which holes lead radially to the bearings. One push on the handle suffices to oil the grinder. A wheel guard is supplied as standard equipment. It can easily be removed for internal grinding. The quick-acting connector enables connection and disconnection from the air line to be accomplished with a short twist.

The four grades of wheels available for use with this tool are as follows: "Kipplox B" for fast steel grinding; "Kipplox H" for light steel grinding; "Kippide" for cast iron and soft metals; and "Kippnomet" for non-metallic materials. There are nine shapes and thirty-two cylindrical sizes of wheels.

Natco Hydraulic Drilling Machine

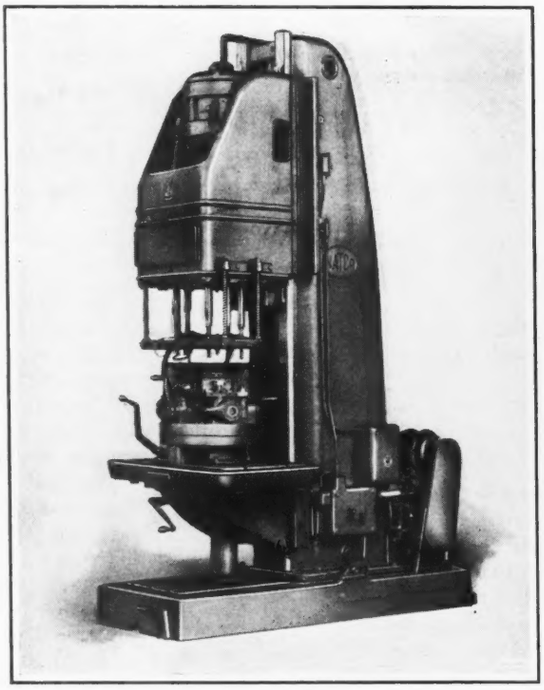
A hydraulically fed machine especially designed for fixed-center multiple drilling has recently been developed by the National Automatic Tool Co., Richmond, Ind. An important feature of this machine is that various cluster boxes can be

easily interchanged to suit individual jobs. This flexibility makes the machine applicable to a wide range of work.

The hydraulic feed is supplied by an Oilgear plunger-type volumetric pump giving a pressure of 1000 pounds per square inch. This high-pressure pump also provides the rapid traverse at its maximum capacity through a differential control system. The rapid-forward, feeding, and reversing motions of the head, as well as stopping, are controlled by a sliding valve mounted on the pump. The movements of this valve are controlled by a trip mechanism of the load-and-fire type. This mechanism is mounted on the right-hand side of the column, and is connected to the foot-treadle at the front of the base.

When the foot-treadle is depressed to start the machine, it loads the control mechanism. However, the travel of the head and the automatic cycle of the machine do not start until the foot-treadle is released. This provision makes it impossible to start the machine at the rapid forward rate, jump the feed-dogs, and enter the work at the rapid speed.

In an emergency, the forward motion of the head can be stopped at any point in the cycle by simply depressing the foot-treadle a second time. This causes the head to reverse instantly, return to the starting position, and stop. With this arrangement, it is impossible to make the head traverse forward rapidly after it has passed a feed-dog. The control is enclosed in one housing.



Natco Hydraulic Drilling Machine Designed for the Quick Interchanging of Cluster Heads

Toledo Four-Point Suspension Press

Power presses with a four-point suspension have been placed on the market by the Toledo Machine & Tool Co., Toledo, Ohio. Fig. 1 shows one of the presses of this new line. The press illustrated has a weight of about 300,000 pounds. Other important specifications are as follows: Bed area, 80 by 120 inches; bed opening, 60 by 112 inches; slide area, 75 by 113 inches; stroke of slide, 18 inches, with 6 inches of adjustment; and die space (distance from top of bolster to under face of slide with the stroke down and the adjustment up), 38 inches.

The four-point suspension is clearly indicated in Fig. 2, which shows the slide and the four pitmans that connect it to the two double-throw crankshafts. The crankshafts are geared together and are synchronized to operate simultaneously. Each of the four cranks exerts a direct and evenly distributed pressure at one of the four corners of the slide. The connections are of an improved design and are adjusted simultaneously by a motor in the slide. Clamping of the adjustment screws is effected from the front and back of the press. The back slide-ways are equipped with removable wearing strips.

These features keep the slide parallel with the bed, even when the work is done at the front or

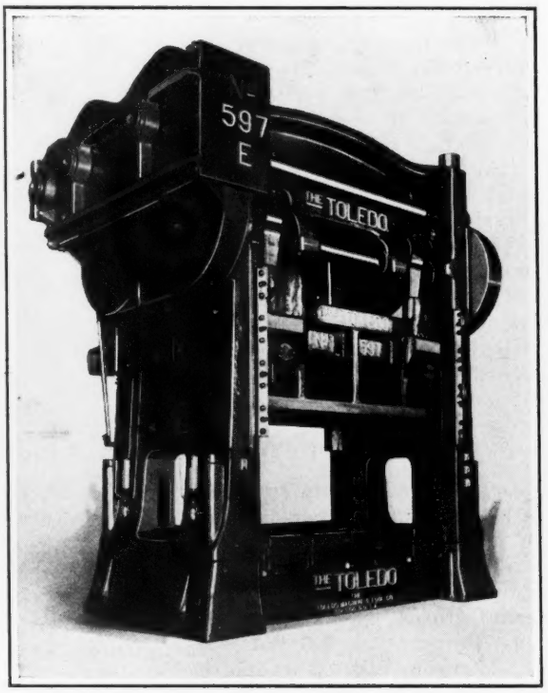


Fig. 1. Toledo Four-point Suspension Press which Weighs 300,000 Pounds

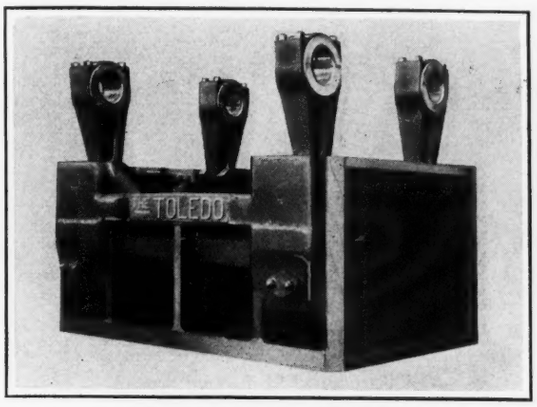


Fig. 2. Toledo Press Slide with the Four Pitmans that Connect it to the Crankshafts

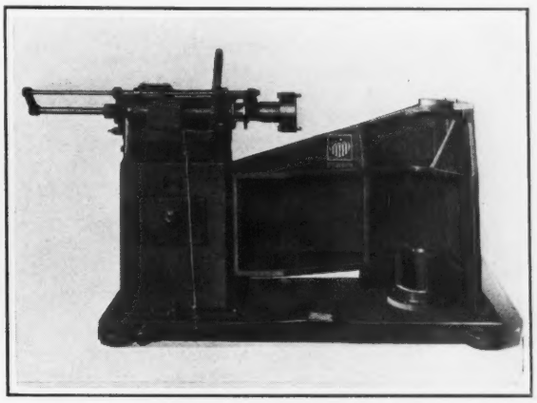


Fig. 2. American Hydraulic Press for Assembling Rear-axle Drive-pinion Units

back edges of a sheet. Thus this type of press is especially adapted to blanking, forming, and stamping parts of large area, particularly articles that are long from front to back. The slide is counterbalanced by two air cylinders built into the crown.

In addition to the main tie-rods, there are four supplementary tie-rods, which add materially to the stiffness of the frame. Cut steel herringbone gears are used throughout the drive. The crankshaft bearings are bronze-bushed, but Timken roller bearings are furnished for all drive and intermediate shafts and for the flywheel. The guards provided for the gears also serve as reservoirs for the oil in which the gears operate.

The press is driven by a 60-horsepower motor belted direct to the flywheel. The clutch is of a patented improved multiple-disk type built directly into the flywheel. Its operating mechanism is of the magnetic type, and a solenoid also controls the brake mechanism. This mechanism operates in harmony with the clutch. Three buttons on the front of the press, together with the control device, permit any arrangement of starting and stopping.

American Assembly Presses

Among the special assembly presses built by the American Broach & Machine Co., Ann Arbor, Mich., is one designed to put automotive mufflers together (see Fig. 1), and one that assembles rear-axle drive-pinion units in axle housings (see Fig. 2). In Fig. 1, the inner core of a muffler is shown placed over the nose-piece on the slide, ready to be pushed into a muffler body. The muffler core has been slipped on plugs mounted on the slide, and the muffler body has been dropped on centering jacks.

In the assembling operation, pressure is applied on the foot-pedal to advance the slide rapidly by means of a hydraulic cylinder. As the assembly is completed, an auxiliary hydraulic cylinder comes into action and applies an extra amount of pressure very slowly to flare the upset ends of the core into the

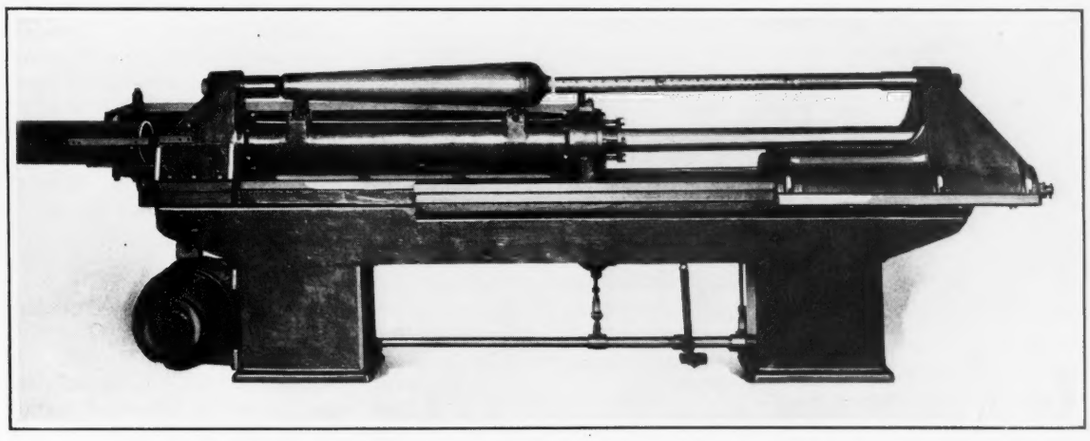


Fig. 1. Hydraulic Press Built by the American Broach & Machine Co. for Assembling Automotive Mufflers

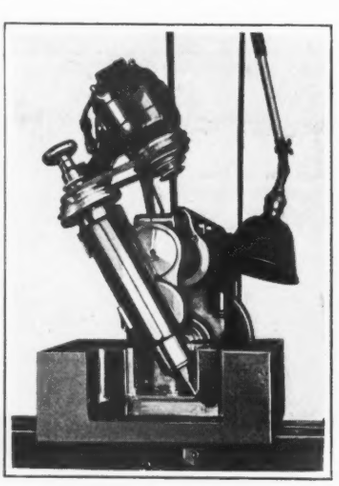
muffler body. Upon releasing the foot-pedal, the slide returns, and the muffler can then be removed.

This machine is actuated by an American hydraulic-pressure pump, mounted in the rear of one of the pedestals. The pedestal itself is used as an oil reservoir. The two cylinders are constructed one within the other to give the two-speed action described. When the high-speed cylinder has accomplished its stroke, it automatically throws in the auxiliary or larger cylinder for the flaring operation. The entire machine cycle requires about twelve seconds.

The press that assembles rear-axle drive-pinion units in axle housings is also operated by an American hydraulic-pressure pump. The ram of this machine is fitted with a head or chuck that receives the complete drive-pinion assembly, consisting of the pinion, roller bearings, and flanged casing. The axle housing is mounted in the receptacle in the lower right-hand section of the press, where it is accurately positioned. Pressure for the operation is applied by means of either the foot-pedal or a hand-lever. The operation requires about ten seconds.

High-Speed Milling Head

Speeds of 800, 1400, 2400, and 4000 revolutions per minute are available with the high-speed milling head here illustrated, which has been brought out by Neff Kohlbusch & Bissell, Inc., 2400 W. Madison St., Chicago, Ill. This head is driven by a 1/8-horsepower ball-bearing motor, which transmits the power through a V-section endless molded belt and aluminum four-step pulleys.

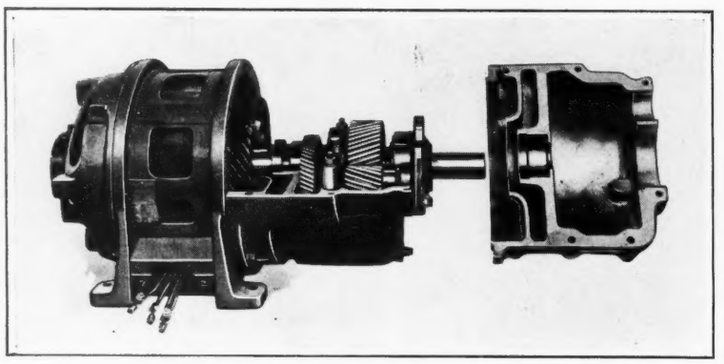


Milling Head which Runs at Speeds up to 4000 R.P.M.

By means of a double pivot construction, the spindle can be positioned at any angle and at any height within the scope of the two centers. This construction permits of using the cutter at a point below the regular spindle of the milling machine and also at a point practically flush with the bottom of the overarm. Accurately ground squaring surfaces parallel to the spindle eliminate guesswork in using the device.

Four bearings are mounted in the ground and lapped steel sleeve which lines the housing for its full length. The bearings are mounted in such a way as to compensate for changes in the spindle length due to temperature changes. The collets are designed with a very small included angle so as to provide positive holding of the cutter. Collets of 3/8 inch maximum capacity are used.

Brackets to fit the user's requirements are furnished for either circular or dovetail overarms. A safety device in the switch makes it impossible to apply current to the motor with the spindle locked. This milling head has a weight of 56 pounds. It can be used for rotary filing as well as for milling.



Westinghouse-Nuttall Combined Reduction Gear and Motor

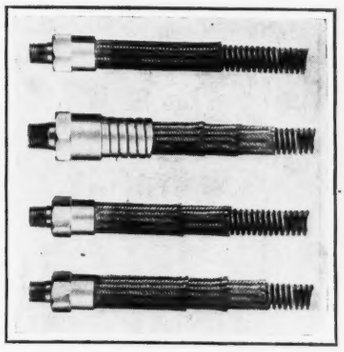
Westinghouse-Nuttall "Gearmotor" Units

Speed reducers combined with motors to form self-contained units only a few inches longer over all than the motors themselves have been developed by the Nuttall Works of the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. These units provide economy in space requirements, simplify installations, and have fewer driven parts. High efficiency of operation and low maintenance requirements are other advantages claimed.

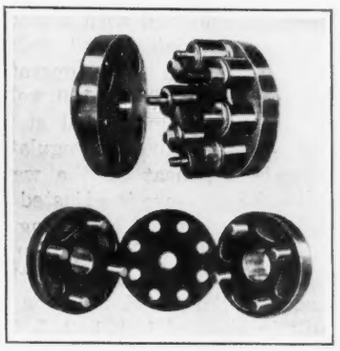
Each unit includes a Westinghouse Type CS general-purpose induction motor and a double-reduction, non-planetary, helical-gear speed reducer. These are built into one frame. An improvement in the motor construction consists of the pre-wound primary core being separable from the stator frame. This feature permits economies in motor operation and maintenance, and also provides for quick and inexpensive changes in the motor speed, voltage, and phase. These "Gearmotors" are built in sizes of from 1/2 to 15 horsepower, with a range of output speeds from 69 to 1550 revolutions per minute.

Bendix Flexible Metallic Tubing

Seamless flexible metallic tubing for which there are numerous industrial applications has been placed on the market by the Bendix-Stromberg Carburetor



Construction of Bendix Flexible Metallic Tubing



Rubber-bushed and Leather-disk Couplings

Co., subsidiary of the Bendix Aviation Corporation, South Bend, Ind. In the machinery field, this tubing can be employed for delivering liquids, steam, or gas to moving parts. It absorbs vibration and simplifies the delivery of lubricant and coolant to the points required.

The tubing is seamless from the tip of one fitting to the fitting at the opposite end, the fittings being brazed or welded to form integral parts of the tubing. This construction prevents the development of leaks and breaks between the tubing and its fittings. The bronze-alloy seamless pipe from which the tubing is made is corrugated to a round thread of single lead.

The protective casing is braided copper, and is provided in one, two, or three layers, depending upon the service for which the tubing is to be used. The manufacturer claims that the tubing has withstood pressures of 10,000 pounds per square inch and temperatures of over 500 degrees F. It is made at present in six sizes, with the internal diameter ranging from 3/16 to 1 inch.

F. A. B. Flexible Couplings

The flexible couplings now being introduced to the trade by the F. A. B. Mfg. Co., 67th and Vallejo St., Oakland, Calif., not only compensate for parallel and angular misalignment, or combinations of the two, but also embody shock-resisting and vibration-eliminating features. The Type R coupling shown at the top in the illustration has rubber bushings, and the Type SL shown at the bottom is provided with a leather disk. These couplings are manufactured in sizes up to 1200 horsepower. The manufacturer states that they require no lubrication and that they operate noiselessly.

Foote Bros. Gear Reduction Unit

The Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has made an addition to its "Hygrade" series of worm-gear speed reducers. The new model is designed to transmit up to 14 horsepower continuously, the capacity depending upon the driving-shaft speed and the reduction ratio.

The new unit is designated size 5-HG, and fills a gap between sizes 4-HG and 6-HG. Like the other sizes, the new reducer will be built in five types—HGS, which has a worm at the bottom; HGT, which has a worm at the top; HGV, which has the worm-gear shaft vertical; HGX, which consists of a worm reducer having a helical-gear attachment; and HGD, which has a double worm and worm-gear reduction. Ratios from 3.5 to 1 up to 3000 to 1 are available.

All shafts run in anti-friction bearings. Usually S K F thrust and radial ball bearings are provided for the worm-shaft, and Timken tapered roller bearings for the worm-gear shaft. The bearings permit a hung-load of 1750 pounds on the slow-speed shaft of the vertical type. The maximum chain pull of the slow-speed shaft is 1375 pounds.

McCrosky Cone-Type Face Milling Cutter

The cone-type face milling cutter here illustrated, which has recently been designed by the McCrosky Tool Corporation, of Meadville, Pa., has serrated blades which are locked in the body by hardened lifting wedges of semicircular shape. Each wedge is brought into contact with the corresponding blade by a hollow set-screw, which is not threaded into the body, but merely bears against the bottom of the wedge recess.

The screw forces the wedge up against the blade. This action, in turn, forces the serrations of the blade into engagement with the serrations in the body slot and holds the blade rigidly in the body. Being semi-circular, the wedge rocks to provide a firm bearing against the blade. To release the grip of the wedge on the blade, it is only necessary to withdraw the set-screw a few turns and tap the wedge with a soft hammer.

Behind each blade is another hollow set-screw which engages threads in the walls of the blade slot. This screw prevents the blade from being forced back by severe cutting strains. The con-

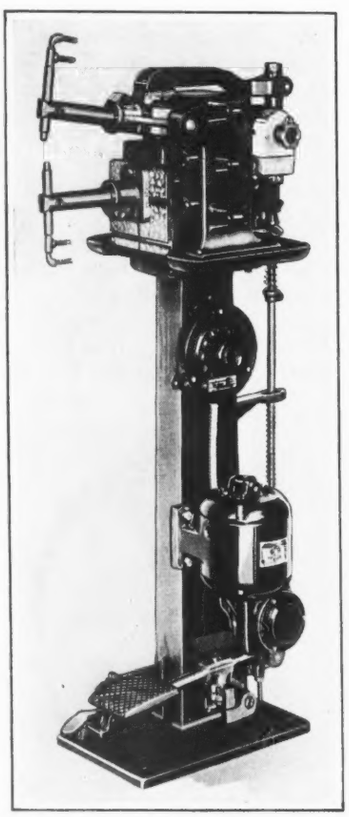
McCrosky Cutter Made in Sizes of from 5 to 20 Inches

struction also provides an easy method of adjusting the blades uniformly for regrinding.

The blades are set in the body at a steep angle in relation to the center line of the cutter. Moving the blades forward a short distance produces a liberal radial expansion without changing the engagement of the serrations. Additional radial adjustments can be obtained by stepping the blades outward one or more serrations. Standard sizes of this cutter for medium-duty service range from 5 to 20 inches in diameter, and special cutters can be furnished to specifications.

Eisler Variable-Speed Spot Welder

The line of "Speed" spot welders built by the Eisler Electric Corporation, 769 S. 13th St., Newark, N. J., has been supplemented by a Series M machine, which is equipped with a motor having a variable-speed reduction gear-head. The operator can make from 30 to 100 welds per minute in graduated steps.



Eisler Motor-driven Spot Welder with Variable-speed Reduction Gear-head

A variable-current regulator controls the heat of the weld, while the pressure is adjusted by means of a nut. The timing is automatic and is kept uniform.

Like the other welders in this line, the Series M machine is built in sizes of 1/2, 1, 3, 5, 10, 20, and 35 kilovolt-amperes. These sizes will weld combined thicknesses of from 0.0005 to 5/8 inch. These welders are particularly suitable for use in the manufacture of radio tubes, incandescent lamps, automotive and electric appliances, metal novelties, and sheet-metal parts.

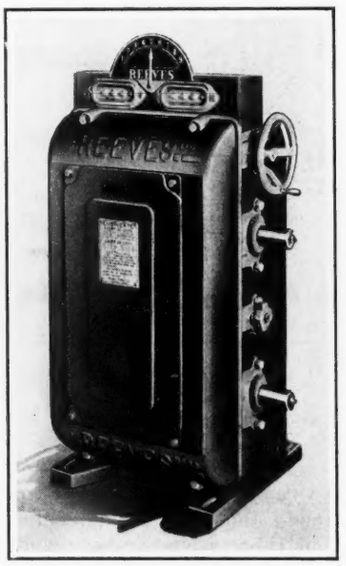
Reeves Vertical Variable-Speed Transmission

To complete its improved line of enclosed variable-speed transmissions, the Reeves Pulley Co., Columbus, Ind., has brought out the vertical design here illustrated. The standard internal operating parts of the horizontal enclosed design are incorporated in the new unit, but it is better adapted for certain installations, particularly where the floor space available is limited.

An oil-tight cast-iron case encloses all operating parts, affording them protection against dust, abrasives, live steam, or other destructive elements. The side cover can be easily removed for inspecting the operating parts or making minor adjustments.

Complete lubrication is available without removing the top section. All radial and thrust shaft bearings are lubricated through eight force-feed fittings located in two exterior panels, as seen in the illustration. Shafts, driving keys, and disk hubs are lubricated by means of force-feed fittings in each of the shaft extensions.

The vertical transmission can be equipped with electric-remote, electric-automatic, and mechanical-automatic controls, and with motors, motor bases, and other accessories to suit various requirements. Any design or type of motor of the proper horsepower can be accommodated. The motor base is adjustable vertically to take up any stretch that may develop in the chain or multiple V-belts used for the drive. This transmission design is available in ten sizes, covering speed ratios of from 2 to 1 up to 8 to 1, inclusive.



Reeves Transmission of Vertical Enclosed Design

Pendent-Type Push-Button Stations

A new line of pendent-type momentary-contact push-button stations designed primarily for controlling motors driving such machine tools as planers and boring mills is being introduced to the trade by the General Electric Co., Schenectady, N. Y. These Type CR-2940 stations may be fitted with sufficient cable so that they can readily be carried about by the operator.

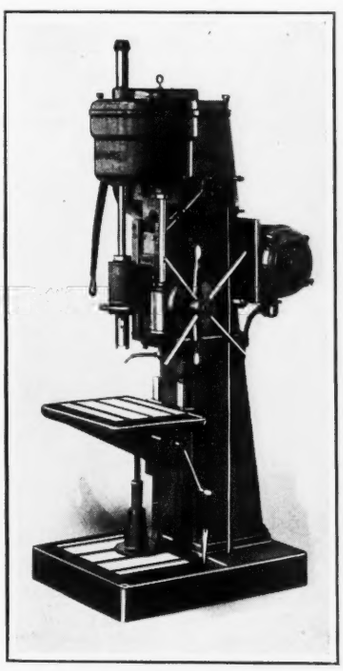
The momentary-contact push-button unit provides both a normally open and a normally closed circuit. The movable contact is a silver-plated disk normally held against two top contacts by a spring. When the button is depressed, this circuit is broken and a circuit is made across the two bottom contacts.

All buttons except the "Stop" button are protected from accidental operation by a guard. The "Stop" button is on the bottom of the case and has a mushroom head, which makes it easily accessible in case of emergency.

Defiance Production Drilling Machine

The Defiance Machine Works, Defiance, Ohio, has brought out a No. 112 drilling machine designed as a single-purpose machine for continuous operation in a production line. However, this machine also has the flexibility of a general-purpose machine. When changes in the product or material require a change in feed or speed, it is merely necessary to transpose the gears, and any one of sixteen speeds from 263 to 1234 revolutions per minute, or sixteen feeds from 0.004 to 0.025 inch per spindle revolution, is quickly available. Special gears can be supplied to meet individual conditions.

The forward and reverse (for tapping) driving clutches are mounted on the main drive shaft, and thus run at a constant speed. They are of the multiple-disk type. The drive is transmitted to the spindle with only three gear contacts between the drive shaft and the spindle drive sleeve. The speed gear train consists of four double gears, multiple-splined to fit interchangeably on the vertical sleeve and shafts. There is a similar arrangement of four double gears in the feed train.



Defiance Single-purpose Drilling Machine with Sixteen Feeds and Speeds Quickly Available

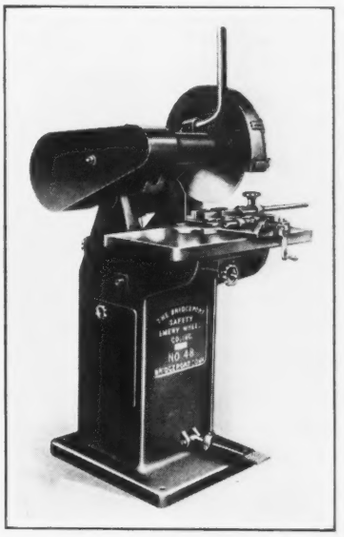
Roller bearings are provided for the drive shaft, and ball bearings for the drive to the spindle. The spindle itself rotates in Timken roller bearings mounted near the nose in a housing attached to a slide that carries the feed-rack. This construction supports the spindle near the nose under all drilling conditions. The bearings used afford a means of maintaining the original alignment and fit.

Multiple-spindle heads may be attached to the lower side of the spindle bearing housing or bolted to the slide. Heads bolted to the slide are driven by a multiple-splined shaft instead of by the spindle. The feed to the slide is engaged by a lever and is disengaged automatically at predetermined depths. The point of disengagement is set by means of a graduated dial.

This machine has a capacity for drilling holes up to 1 1/2 inches in steel with high-speed steel drills. The distance from the center of the spindle to the face of the column is 10 1/2 inches, and the spindle has a travel of 12 1/2 inches. The net weight of a belt-driven machine is 3100 pounds, and of a motor-driven machine, 3300 pounds.

Bridgeport High-Speed Cut-Off Machine

Unusually fast cutting speeds and easy handling of the material are the two main claims made for an abrasive-disk cut-off machine now being placed on the market by the Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn. Light sections of all kinds of material can be cut, and the machine is particularly adapted for cutting non-ferrous metals. Very hard or tough metals, such as hardened tool steels, high-speed steel tool bits, drills, or drill rod, Allegheny metal, etc., can be cut with ease.



Bridgeport Abrasive-disk Cut-off Machine

The cutting disk is driven at a speed of 5200 revolutions per minute, producing a wheel speed of 16,000 feet per minute. Power from the 7 1/2-horsepower motor to the disk is delivered through six V-belts. The disk head and the motor balance each other on a rocker shaft, mounted in Timken bearings that are sealed against grit. The unit rocks with minimum effort on the part of the operator. The motor may be rocked separately to permit slackening the driving belts for changing or for taking up slack.

The standard vise takes sections up to 2 1/2 inches, holding them either straight or for angle cuts up to 45 degrees. The vise can be quickly removed in order to substitute other holding means, when desired. It is roughly adjusted to the size of section to be cut by means of a swinging crank, but the clamping is done through a draw-rod and foot-treadle. This arrangement leaves both hands of the operator free to handle the material and operate the cutting

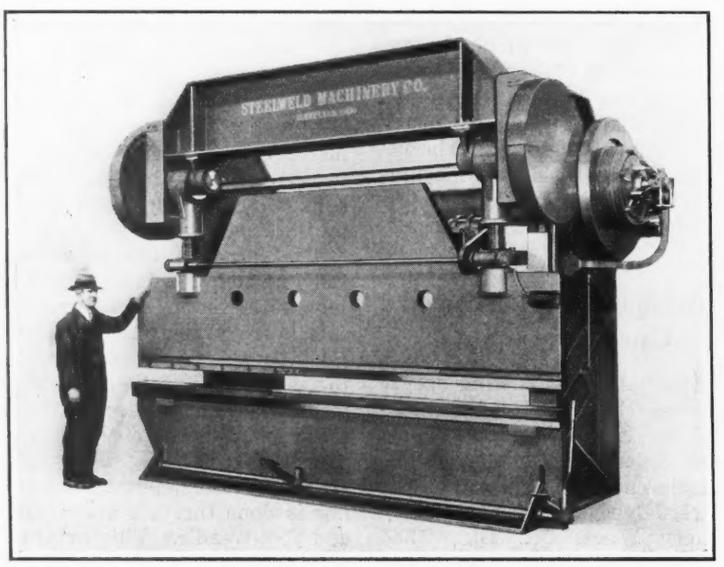
head. The machine is regularly furnished with a 12- by 3/32-inch disk, but 14- or 16-inch disks can also be provided.

Steelweld Bending Brakes

Rolled-steel welded bending brakes of the construction illustrated are now being built by the Steelweld Machinery Co., E. 70th St. and Machinery Ave., Cleveland, Ohio. Power is applied in the conventional manner, through overhead eccentrics, to the movable ram. The housings, instead of being iron or steel castings or being cut from rolled plate, are built up of welded sections. The stress members in the throat are heavy and are so arranged that deeper throats can be supplied with safety. Whenever practicable, the manufacturer prefers to ship the machine whole, except for the bed, so as to eliminate bolts and rivets as far as possible. Both the ram and bed are extended beyond the left-hand housing. This is an advantage in jobbing work and also provides a long die surface for narrow work.

A Twin Disc clutch is employed on these machines. The operating levers move on ball bearings so as to reduce friction and fatigue of the operator. All gears are of the Sykes herringbone type. The ball-joint connection is claimed to be unbreakable in service. Meehanite iron castings are used for the slide bearings and eccentric straps, while the flywheel is made of rolled steel. The flywheel is mounted on Timken bearings. The pinion is forged integral with the flywheel shaft, and the eccentrics are forged solid with the main shaft.

The power elevation to the ram is controlled electrically. It is self-locking and practically fool-proof, the motor being arranged to stall before damage to the mechanism occurs. Pressure grease lubrication from a central station is provided. Machines with different strokes, throats, die clearances, or bed and ram widths can be readily supplied.



Steelweld Bending Brake of Rolled-steel Welded Construction

Air-Operated Automotive-Valve Grinder

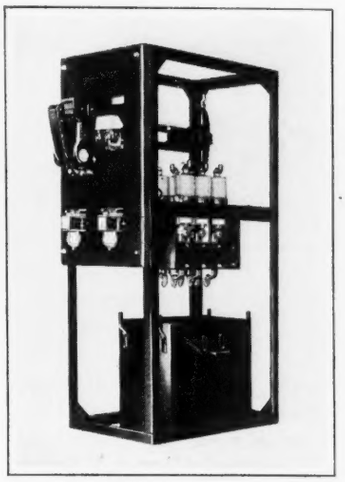
An air-operated valve grinder which can be used at speeds up to 3000 oscillations per minute has been brought out by the Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, Ohio, for use in automotive shops, service stations, and garages. It is claimed that the speed of this grinder greatly reduces the time of hand-grinding.

Valve Grinder that Operates at 3000 Oscillations per Minute

The tool operates automatically when pressure is applied by the user, the speed being increased or diminished according to the pressure. The grinder weighs only 1 1/2 pounds. It is 8 inches long by 2 inches outside diameter. There are only five main parts—the body, shaft, valve block, cylinder, and driver. The air consumption is 6 cubic feet per minute.

Burgess Vacuum-Contact Toggle Switch

A switch having sealed-in-vacuum contacts has been produced by the Burgess Battery Co., 202 E. 44th St., New York City. This switch is flame-proof, free from dust and dirt, positive, of low resistance, quick-acting, and corrosion-proof. The vacuum contact is mounted in a holder on the rear face of the switch plate. Throwing a handle to the closed position serves to actuate the external glass stem of the vacuum contact, either making or breaking the circuit as desired. This switch is rated at 8 amperes intermittently or 6 amperes continuously, with 220-volt current. It is especially applicable in places where there is fire or explosion hazard and in laboratories.



Allen-Bradley Switch for Motors of High Voltage

Starting Switch for High-Volt Induction Motors

A three-pole, magnetically operated oil switch has been developed by the Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis., for starting standard squirrel-cage and high-reactance squirrel-cage motors of ratings up to 750 horsepower, 2500 volts. These switches can also be used as primary switches in connection with slip-ring motors.

They are furnished for standard frequencies of from 25 to 60 cycles. The control circuits are of low voltage, allowing standard push-buttons and other standard control accessories to be used. Close overload protection is afforded by two combination magnetic-inducto-therm relays, which are adjustable for current tripping values.

Frew "Vee-Driv" Hand Milling Machine

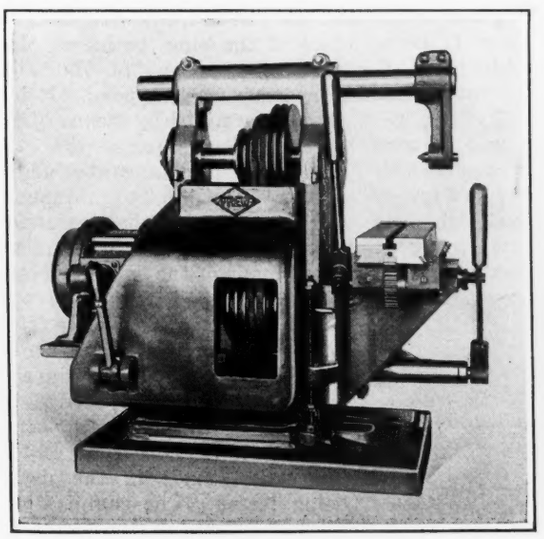
A medium-sized hand miller with an integral motor drive which transmits the power to the machine by V-belts has been placed on the market by the Frew Machine Co., 132 W. Venango St., Philadelphia, Pa. This "Vee-Driv" machine is a redesign of the No. 2 belt-driven hand miller made by the concern. The main column of the machine has been "belled out" to receive the motor, which is mounted on a pivoted plate. Tension is maintained on the belts by applying part of the motor weight.

Three-step cones on the spindle and motor shaft provide three spindle speeds. To shift the belts, the operator depresses the hand-lever at the side of the machine, thus raising the motor unit and slackening the belt. When the belts have been shifted, the lever is merely released to place them under tension again.

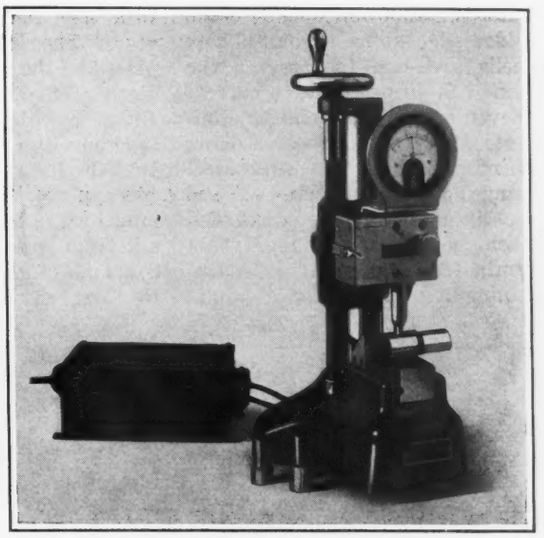
The spindle is provided with Timken roller bearings, permitting spindle speeds up to 2000 revolutions per minute to be obtained. The minimum spindle speed recommended is 200 revolutions per minute. The roller bearings can be easily adjusted to take up wear. The three-step spindle cone is of sufficient weight to produce a flywheel effect, which reduces the liability of chatter. This machine can be furnished in either bench or floor types.

Pratt & Whitney "Electrolimit" Gage

The Pratt & Whitney Co., Hartford, Conn., has brought out a new adaptation of the "Electrolimit" gage in the form of a comparator for external gaging. This instrument, which has a capacity of 4 inches, comprises a cast-iron base which supports an anvil and column on which the gaging head is mounted. The anvil is made of hardened steel and is chromium-plated, while the column consists of a hollow steel cylinder, also chromium-plated. An adjustable back-stop facilitates the gaging of cylindrical parts. The anvil can be removed easily and turned over in order to use the V-block on the reverse side. Special an-



Frew Hand Milling Machine with Integral Motor Drive that Transmits Power through V-belts



Electric Gage with Indicator that Travels 7/16 Inch for Each Size Variation of 0.0001 Inch

vils can be substituted to meet requirements.

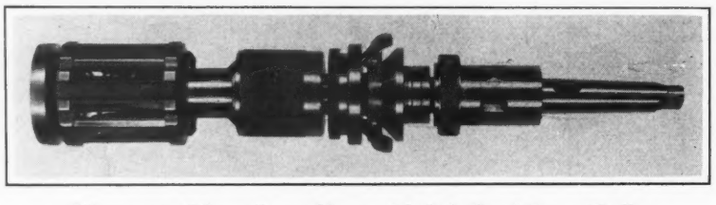
The electrical power unit is contained in the enameled metal box at the left, which measures 5 by 4 by 8 inches. It is the only electrical equipment required for using the gage on 110-volt, 60-cycle current. A transformer in the unit reduces the circuit to 10 volts. A voltage regulator reduces inaccuracies of the gage caused by fluctuations in the line voltage to about one millionth of an inch for each volt change, which is a negligible amount.

The micro-ammeter mounted on the gaging head has a 2 1/4-inch scale. The standard magnification of the circuit causes the needle to travel about 7/16 inch for each 0.0001 inch variation in the size of the parts gaged. However, the magnification can be increased or decreased to suit special conditions. The electrical parts of this gage are made by the General Electric Co., and the other parts by the Pratt & Whitney Co.

Micromatic Improved Automatic Hone

Improvements embodied in the three-finger automatic hone here illustrated, which was recently designed by the Micromatic Hone Corporation, DuBois St. at Horton Ave., Detroit, Mich., include the adoption of soft steel, folded-edge stone shells. These shells are said to increase the stone life 40 per cent, to correct uneven stone wear, and to eliminate the possibility of scoring cylinder walls. The soft steel stampings are inexpensive, and are intended to be discarded when the stones wear out. This eliminates the necessity of maintaining a stock of extra stone-holders and simplifies stone replacement.

Other improvements include a drive ball that is made solid with the drive shaft, so as to increase its strength; a recoil spring that insures quick and positive collapse of the hone; and wider bearings on the bodies and flanges to insure better fits and permit easier assembly. All wearing surfaces are carburized, hardened, and ground.



Micromatic Three-finger Hone with Soft Steel Stone Shells of New Design

Dwarf Brinell Press

A portable hardness testing instrument that can be used in any shop where an arbor press, drilling machine, vise, heavy C-clamp, or other means of applying pressure is available is shown

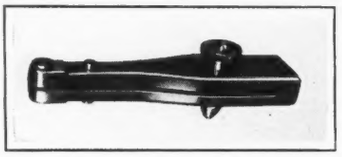


Fig. 1. Instrument Used in an Arbor Press, Vise, etc., for Determining Hardness

in Fig. 1. This instrument, which is designated the "Dwarf Brinell press," is based on the Brinell principle of making an impression in the metal to be tested by applying a known load to a steel ball of a given diameter. The instrument is being placed on the market by the R. Y. Ferner Co., 1131 Investment Bldg., Washington, D. C.

From Fig. 1, it will be seen that the instrument consists of a piece of steel about 7 1/4 inches long by 7/8 inch thick, which is slit from one end to within about 3/4 inch of the other end, so as to form a two-pronged spring.

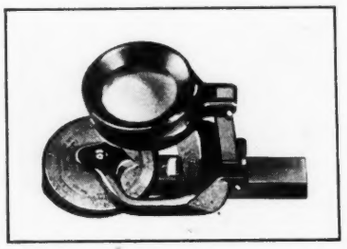


Fig. 2. "Evolute Loop" for Finding the Diameter of the Ball Impressions

On the under side of the instrument near the end of the slit, there is a hole for a steel ball 5 millimeters in diameter. Opposite this ball, on the upper prong, is a knurled knob to which pressure is applied. In using the instrument, the ball point is held against the piece to be tested. A pressure of 750 kilograms is applied for thirty seconds after the full load is reached.

The pressure is determined by the sense of touch. In the lower prong of the instrument, at the small end, there is a pin about 5/16 inch in diameter, which extends through a hole in the upper prong. The upper end of this hole is provided with a flat ring, and when no load is applied, the end of the pin is about 1 millimeter below the surface of the ring. When pressure is applied, the user holds his thumb or finger over the surface of the ring and when he feels that the end of the pin is flush with the surface of the ring, he knows that the full pressure of 750 kilograms has been applied. It has been determined by means of instruments and gages that the position of the pin can be judged accurately within 0.01 millimeter.

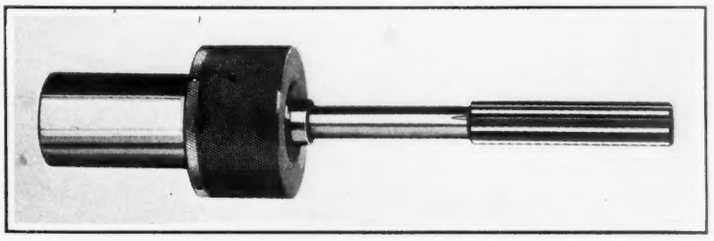
For measuring the impression obtained with the instrument, use is made of the "evolute loop," illustrated in Fig. 2, which comprises a magnifying glass fitted with a cam having a rim with an evolute curve. The procedure is as follows: A beveled edge on the base of the device is placed in contact with one edge of the impression made in the metal being tested. The cam is then rotated until its edge comes in contact with the opposite edge of the impression. By means of a

scale attached to the cam and a suitable index, the diameter of the impression can be read direct to twentieths of a millimeter, and the diameter can be estimated to hundredths of a millimeter. The dial also shows the Brinell hardness number and, for tests on steel, a scale of tensile strength.

Scully-Jones Short-Nose Floating Reamer and Tap Holder

The short-nose floating holder for reamers and taps here illustrated is being placed on the market by Scully-Jones & Co., 1901 S. Rockwell St., Chicago, Ill. Like the standard floating holders made by this concern, the new holder can be used in automatic screw machines and turret lathes. However, it is particularly designed for multiple-head reaming and tapping machines. In the new holder, the collet is withdrawn within the tool body. The overhang and the over-all length have been reduced, compared with the standard holder.

The shoulder of the collet floats between two sets of ball thrust-carriers. One set carries the weight of the tools when the holder is mounted in a vertical position, and the other takes the thrust of the cut. Side float is limited by the clearance between the hole in the outer adjusting nut and the outside diameter of the collet. The clearance is usually 0.015 inch. The floating feature enables parallel alignment to be maintained when the hole being tapped or reamed is off center with the machine spindle.

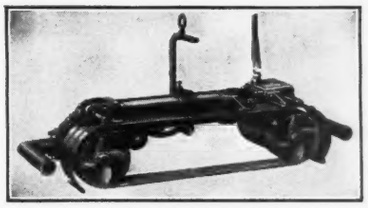


Scully-Jones Floating Holder Designed Particularly for Multiple-head Reaming and Tapping Machines

"Hicycle" Portable Belt Grinder

A portable electrically driven machine for grinding and polishing straight or curved surfaces of metal, wood, and stone is shown in the illustration. This device has been added to the line of "Hicycle" equipment made by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City. In the metal-working field, the tool is particularly useful for smoothing down welds, large steel dies, cowls and back panels of automobile bodies, etc.

The flexible endless abrasive belt is driven by two motors, one at each end. These motors have a low slip or drop in speed under load, so that a high cutting speed

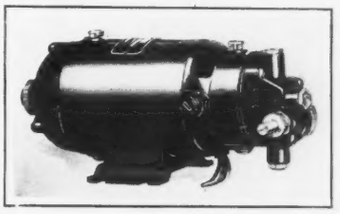


Portable Belt Grinder Made by the Chicago Pneumatic Tool Co.

is maintained under varying loads or belt pressures. The motors are totally enclosed, preventing the lubricant of the ball bearings from getting on the work and foreign matter from getting into the motors or their bearings.

Bodine Universal Motor with Electric Governor

A new line of series-wound motors with improved electric governors has been produced by



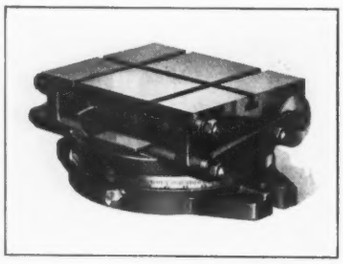
Bodine Universal Motor with an Improved Electric Governor

the Bodine Electric Co., 2264 W. Ohio St., Chicago, Ill., for such applications as talking motion-picture equipment, electric pyrometer control drives, traffic-signal controls, etc. Accuracy approaching clock time and rapid acceleration are features claimed for these motors. They are available in two forms—Form R, which is adjustable while running, and Form S, which is adjustable only when standing still.

The same concern has also brought out a small motor with wool-packed bearings. This motor is designated the Type N-3 and is similar in design to the Type N-5 described in December, 1930, MACHINERY, page 316. However, it is rated at 1/20 and 1/15 horsepower at 1725 and 3400 revolutions per minute, and 1/30 and 1/20 horsepower at 1125 revolutions per minute. Synchronous and split-phase induction motors, and series and shunt direct-current motors are available in the new frame. The wool-packed bearings prevent flooding. A simplified cut-out of patented design is another feature of these motors.

Taft-Peirce Angle-Plate

An adjustable angle-plate that provides a rapid and convenient method of setting up angular work on the grinder, milling machine, shaper, drilling machine, or jig borer has been designed by the Taft-Peirce Mfg. Co., Woonsocket, R. I. As will be seen from the illustration, the fixture consists of a tilting table hinged at one end to a base. This base is rotatable on a sub-base which is fitted with holding lugs and a bottom key for securing it to the table of the machine.



Taft-Peirce Angle-plate which is Adjustable to Compound Angles

The rotating base is graduated and makes possible quick set-ups for machining work to compound angles. The tilting table can be set for ordinary purposes by the aid of a built-in protractor. If extreme accuracy is required, sine-bar buttons can be attached. The top surface of the table measures 8 by 10 inches.

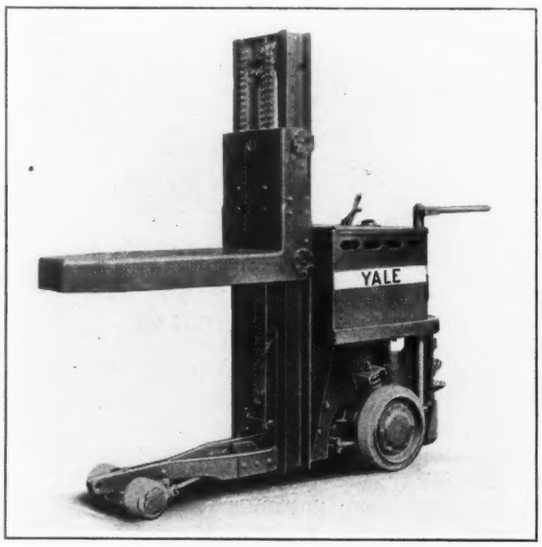
Cutler-Hammer Heavy-Duty Lifting Magnet

A 30-inch heavy-duty lifting magnet has been produced by Cutler-Hammer, Inc., 264 N. 12th St., Milwaukee, Wis., for use when the direct-current generator must be small and the lifting capacity of the magnet high. Only a 2 1/2-kilowatt generator is required. The new magnet is of essentially the same design as the larger Cutler-Hammer "Red-Top" lifting magnets. It weighs about 1300 pounds.

Cutler-Hammer Magnet which Requires only a Small Generator

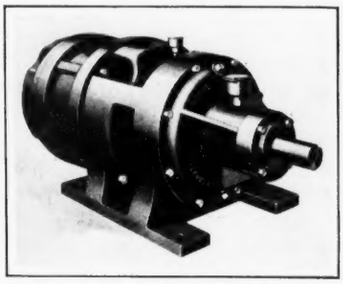
Yale "Midget" Electric Trucks

The Philadelphia Division of the Yale & Towne Mfg. Co., has brought out a line of "Midget" KM series trucks, which are small in size and yet have capacity ratings of 3000 and 4000 pounds. The over-all width of these trucks is 29 inches. The over-all length of the high- and low-lift models, with a standard load platform 42 inches long and with the operator's platform folded up, is approximately 80 inches. These dimensions make the trucks suitable for operation where floors or elevator capacities are limited or where trucks must negotiate narrow aisles and congested areas.



One of a New Series of Yale Trucks Made in 3000- and 4000-pound Capacities

In addition to the high- and low-lift models, which have a six-wheel steering feature, there are also high- and low-platform load-carrying types and high-lift fork types. The main drive controller used in these trucks has four speeds in either direction and starts the truck smoothly. This controller interlocks with the driving brake, so that the operator must return the controller handle to the neutral position after releasing the brake before driving power can again be obtained.



Self-powered Speed Reducer Built by Gears & Forgings, Inc.

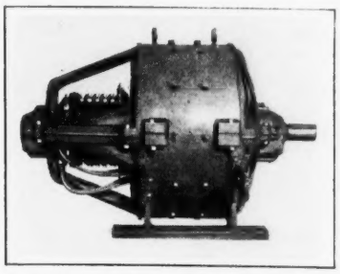
Planetary-Type Motorized Speed Reducer

A speed reducer of the planetary type, built integral with an electric motor to form a neat and compact unit, has recently been placed on the market by Gears & Forgings, Inc., Cleveland, Ohio. This self-contained speed reducer is designed particularly for applications where the available space for the driving mechanism is limited. Obviously, the planetary design has the advantage of requiring small space.

The housing of the reduction gears is integral with the base, the latter extending to the center line of the motor. The motor shaft runs in two ball bearings. This speed reducer is built in thirty-four standard ratios, ranging from 4 to 1 up to 240 to 1, and in sizes from 1/4 to 30 horsepower.

Reliance Large-Sized Direct-Current Motors

Motors ranging in size from 100 horsepower at 800 revolutions per minute to 350 horsepower at 1200 revolutions per minute have been added to the Type T direct-current line of motors made by the Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Road, Cleveland, Ohio. These motors are of rolled-steel, split-frame construction. The feet and supporting mem-



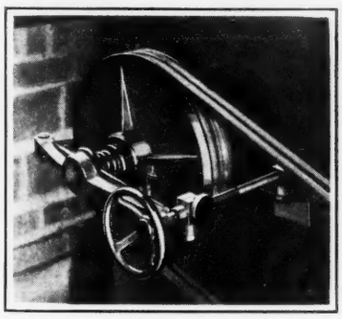
Reliance Motor Made in Sizes from 100 to 350 Horsepower

bers are heavy bar steel welded to the frame. The brackets and sleeve bearings are of a split design. The motors are supplied for constant-speed service or for adjustable-speed service with a range of 2 to 1 or 3 to 1.

Smith Variable-Speed Unit

The Smith Power Transmission Co., Penton Bldg., Cleveland, Ohio, has developed a unit designed to be mounted on driven shafts when variations in speed are required. The illustration shows a typical application. By merely turning a handwheel or screw, the speed can be adjusted from zero to the maximum speed of the ratio. Ratios as high as 9 to 1 are obtainable.

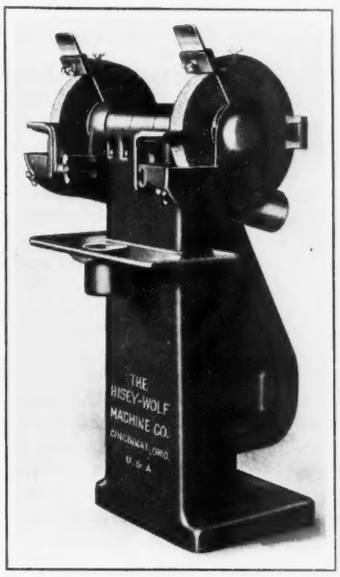
This unit can be used in flat-belt, V-belt, and silent or roller chain drives. It can also function as a clutch, and thus eliminate the need of high-torque starting motors for such service as driving fans or blowers. The unit is shock-absorbing and does not exert additional bearing loads. It is available in sizes up to 5 horsepower.



Variable-speed Unit which is Mounted on Driven Shafts

Hisey "TexDrive" Grinder

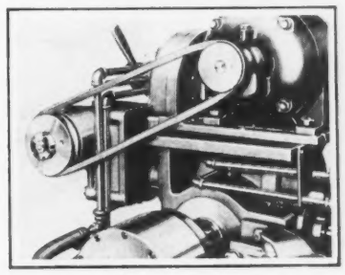
A "TexDrive" grinder designed for 10-, 12-, and 14-inch vitrified or high-speed grinding wheels has been added to the line of machines made by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The wheel-spindle is driven through V-belts by a motor mounted on the back of the pedestal. Ball bearings or Timken roller bearings are provided for the spindle. The bearing boxes are keyed to the pedestal, and can be removed as a complete unit with the spindle to permit quick renewal of the belts without disturbing the bearings.



Hisey "TexDrive" Grinder with Motor on Pedestal

Work-Head Drive for Peerless Chamfering Machine

The Peerless Model No. 3 chamfering machine made by the City Machine & Tool Works, E. 3rd and June Sts., Dayton, Ohio, has been equipped with a combination geared-head reduction motor for driving the work-head. This driving method was described in the April, 1931, number of MACHINERY, page 640.



Optional Work-head Drive for Peerless Chamfering Machine

An optional drive is now available, consisting of a separate motor and reduction unit. Standard motors may be used, the power being transmitted to the reduction unit through V-belts, as illustrated. With this type of drive, the operating speed of the work-head can be changed to suit individual jobs.

Automatic Connecting-Rod Testing Equipment

The Toledo Precision Devices, Inc., subsidiary of the Toledo Scale Co., Toledo, Ohio, has developed two machines for weighing and correcting automotive connecting-rods. In the first of these machines the initial weighing of the connecting-rod is performed. For this operation, both ends of the rod are attached at the same time to two instruments mounted side by side on the machine. Two charts then register simultaneously the overweight of each rod end. Thus, both ends are weighed in one operation.

After the overweight has been ascertained, the operator sets the dials of the second machine accordingly. This machine has two instruments with pans to receive the chips that are removed from the connecting-rod. An automatic cut-off device connected with a shaving machine is placed next to the chip pans. The connecting-rod is placed in the shaving machine and pared to the proper weight, the chips falling into the receiving pans. When the correct amount of stock has been removed, the automatic cut-off device stops. One man runs both machines.

Men in the Industry

E. J. LEES, well known in the machine tool industry, has joined the National Tool Co., Cleveland, Ohio, in the capacity of engineer.

GLEN F. HAWKEY has been elected vice-president of the Cleveland Duplex Machinery Co., Inc., Cleveland, Ohio. Mr. Hawkey has been associated with the company for the last fourteen years.

FREDERICK T. POTTER has been elected president of the Stark Tool Co., Waltham, Mass., after seven years' service. E. CLIFFORD POTTER continues to hold the offices of vice-president and treasurer.

HENRY H. TIMKEN, JR., has been made assistant to the president of the Timken Steel & Tube Co., Canton, Ohio. He has been serving as assistant works manager of the Timken Roller Bearing Co. for the last two years.

R. H. BALL, for a number of years with the Warner & Swasey Co., is now with the Cleveland Duplex Machinery Co., Inc., Cleveland, Ohio, as sales engineer. Mr. Ball is a graduate in mechanical engineering of the Ohio State University.

KENNETH B. SPAULDING, formerly sales manager of the McCrosky Tool Corporation, Meadville, Pa., has been appointed sales manager of the Davis Boring Tool Co., St. Louis, Mo., maker of expansion boring tools, reamers, and cutters.

C. A. ANDERSON has been appointed general manager of the Wright Mfg. Co., Bridgeport, Conn., manufacturer of chain hoists. R. C. BLAIR has been made assistant sales manager, with headquarters at the company's plant at York, Pa.

WILLIAM GROVE, formerly with the Ingersoll Milling Machine Co., Rockford, Ill., is now associated with the sales engineering department of William Sellers & Co., Inc., Philadelphia, Pa. Mr. Grove will specialize on planer type milling machines and floor borers.

WILLIAM E. UMSTATTD has been made executive vice-president of the Timken Roller Bearing Co., Canton, Ohio. Mr. Umstattd has been with the Timken organization for thirteen years, during the last two years of which he has occupied the capacity of factory manager.

JOHN H. VAN DEVENTER has been appointed editor of the *Iron Age*, succeeding WILLIAM W. MACON, who becomes consulting editor. Mr. Van Deventer is a graduate of Cornell University, class of 1903, and has a long and varied experience both in the industrial and the editorial fields.

D. W. DEAN has been appointed manager of the control section of the Industrial Department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Dean has been in the employ of the Westinghouse company since 1921. He is recognized as an authority on the design and application of steel mill equipment.

R. D. EAGLESFIELD has been appointed district manager in charge of motor and welder sales for the Lincoln Electric Co., Cleveland, Ohio. Mr. Eaglesfield will make his headquarters at 314 E. 16th St., Indianapolis, Ind. Before joining the technical sales force of the Lincoln Electric Co., he was a manufacturer of motor-driven machinery.

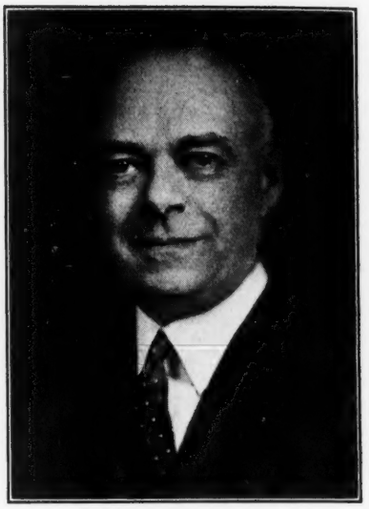
T. H. WICKENDEN, since 1922 in charge of the development work in the automotive and aeronautical fields of the International Nickel Co., Inc., New York City, has been appointed assistant manager of development and research for the company. Mr. Wickenden is a graduate of the University of Michigan and has a broad experience in the automotive field.

G. B. WARREN has been appointed designing engineer of the steam turbine section, and M. A. SAVAGE designing engineer of the steam turbine generator section of the General Electric Co., Schenectady, N. Y. J. H. DORAN has been appointed assistant on mechanical design for the turbine engineering department, and W. E. BLOWNEY administrative assistant.

EVERETT S. LEE has been appointed engineer of the General Engineering Laboratory of the General Electric Co., Schenectady, N. Y., to succeed the late Louis T. Robinson. Mr. Lee is a graduate of the University of Illinois, class of 1913. He has been employed for many years in the General Engineering Laboratory of the company, and in 1928 he was made an assistant engineer of the laboratory.

E. A. PHILLIPS, eastern sales manager of Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has had his activities extended to act in a supervisory capacity over the offices at Buffalo, N. Y., and Philadelphia, Pa. Mr. Phillips' office is at 225 Broadway, New York City. The New York office is in a position to handle estimating and engineering service for all customers within its territory.

HENRY H. PECK, formerly with the Standard Steel Works Co. of Burnham, Pa., has joined Lukenweld, Inc., Coatesville, Pa., as manager of sales. The latter company is a division of the Lukens Steel Co., and is engaged in the manufacture of arc-welded rolled-steel parts for all types of machinery and equipment. Mr. Peck has been associated for many years with iron and steel foundries throughout the country, principally in the sale of castings. He succeeds JOHN S. BLEECKER in charge of sales. Mr. Bleecker has been appointed manager of sales research and advertising for Lukens Steel Co. and its divisions, Lukenweld, Inc., and By-Products Steel Corporation.



Henry H. Peck, New Manager of Sales of Lukenweld, Inc.

CHESTER H. LANG, formerly assistant manager of the publicity department and later comptroller of the budget of the General Electric Co., Schenectady, N. Y., has been appointed manager of the publicity department to succeed MARTIN P. RICE, who retired December 31 after more than thirty-seven years of service with the company. Mr. Lang entered the employ of the company in 1919.

H. J. FRENCH, since 1929 a member of the research staff of the International Nickel Co., Inc., at its laboratory in Bayonne, N. J., has been placed in charge of the development work in steel and iron in the research department in New York. Mr. French is a graduate of the School of Mines, Columbia University. In 1930, he was awarded the Henry M. Howe medal of the American Society for Steel Treating.

R. L. SUHL, for the last three years assistant to the late Frederick S. Jordan, succeeds him as manager of the nickel sales department of the International Nickel Co., Inc., New York City. Mr. Suhl went with the original International Nickel Co. in 1903 as laboratory assistant. He was made superintendent of electrolytic refining in 1908. In 1920 he joined the headquarters staff in New York as development engineer, and in 1928 he became assistant sales manager of the nickel department.

News of the Industry

FRANKLIN H. FOWLER has been elected president of Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., to succeed JAMES F. GRISWOLD, who has resigned in order to devote his time to other business interests. Mr. Fowler is a graduate of the Annapolis Naval Academy, class of 1909, and brings to the company a wide and well balanced business experience, embracing the various branches of sales, manufacturing, engineering, administration, and finance. For the last two years he has been president and general manager of the Construction Machinery Co. of Waterloo, Iowa.

JOHN E. BARKLE has been appointed general manager of the South Philadelphia Works of the Westinghouse Electric & Mfg. Co. Mr. Barkle has been with the Westinghouse organization since 1901. In 1916, he was made superintendent of a factory erected by the company at East Pittsburgh for the manufacture of munitions. Later, he was placed in charge of all the district office shops as general superintendent, and in 1926 he was made superintendent of manufacturing of all generating apparatus at East Pittsburgh. In 1929 he was appointed works manager of the South Philadelphia Works.

R. A. CLARK has been appointed New England representative of the Baker-Raulang Co., Cleveland, Ohio, with headquarters at 260 Park Square Bldg., Boston, Mass. Mr. Clark has had much experience in selecting, installing, and servicing truck equipment in the San Francisco district. FRANK E. WITTE and H. S. FULLER will handle the Baker-Raulang Co.'s sales on the Pacific Coast. Mr. Witte is president of the Frank E. Witte Co., 1061 Howard St., San Francisco, Calif. He will carry a complete stock of repair parts, as well as standard models of trucks. Mr. Fuller's headquarters will be at 810 Terminal Sales Building, Seattle, Wash., and he will cover the Pacific-Northwest territory.

ALOIS HAUSER, assistant works manager in charge of engineering, both for the bearing factories and the steel mills of the Timken Roller Bearing Co., Canton, Ohio, has resigned his position, which he has held since 1920. Mr. Hauser came to the United States in 1907 after severing his connection with one of the largest steel plants in Austria, where he acted in the capacity of master mechanic. His first connection in this country was with the engineering department of the United States Steel Corporation, where he was employed as departmental supervisor. From there he went to the Bethlehem Steel Corporation, serving as efficiency engineer for three years. Mr. Hauser has had charge of the expansion program of the Timken Roller Bearing Co., and now that this program has been completed, he expects to take a much needed vacation. His plans for the future have not yet been announced.

FEDERAL MACHINE & WELDER CO., Dana Ave., Warren, Ohio, has moved its St. Louis office to 4116 Clayton Ave.

ALBERT WRIGHT, manufacturer of screw machine products, announces his removal from 700 Second Ave. to 2180 Folsom St., San Francisco, Calif.

HALPIN-KOHBRY, INC., 4116 Clayton Ave., St. Louis, Mo., has been appointed exclusive distributor in the St. Louis territory for Hobart constant-arc welders.

STANLEY TOOLS, New Britain, Conn., announce the purchase of the rule business of HIRAM A. FARRAND, INC., Berlin, N. H., developer and manufacturer of the Farrand rapid rule.

CHAS. A. SCHIEREN CO., 30 Ferry St., New York City, manufacturer of belting, announces that the Boston branch of the company has removed from 727 Atlantic Ave. to 186 Lincoln St., Boston, Mass.

L. NEWMAN TOOL, DIE & MACHINE WORKS have removed from their former location at Alameda, Calif., where the company has been located for the last ten years, to new quarters at 1001 Twenty-fourth St., Oakland, Calif.

BRADFORD MACHINE TOOL CO., Cincinnati, Ohio, announces that the receivers appointed for the company intend to continue to operate the business. The company is prepared to fill all orders the same as heretofore, and will continue to do so.

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., have purchased the stock and good will of the steel department of H. D. Taylor & Co., Buffalo, N. Y. The stocks taken over include hot- and cold-rolled bars, shapes, plates, sheets, etc.

ROBINSON H. HARSH, 225 Emerson St., N.W., Washington, D. C., announces that he has placed on the market a new type of resilient ball bearing, suitable for carrying the sliding parts and drawers of metal furniture and absorbing vibration in machinery, as well as for use on casters.

DOEHLER DIE CASTING CO., 386 Fourth Ave., New York City, has purchased from the National Lead Co. all the equipment, inventories, and good will of the NEWTON DIE CASTING CORPORATION, New Haven, Conn. Most of the equipment will be moved to the Doehler plant at Pottstown, Pa.

FOSTER MACHINE CO., Elkhart, Ind., announces that the company's line of screw machines, turret lathes, and automatic chucking machines is now handled in the Chicago territory by the Dean Machinery Co., assisted by Harry Lyon, who has been a direct Foster representative for many years.

HUTTO ENGINEERING CO., INC., 515 Lycaste Ave., Detroit, Mich., elected the following officers at a recent meeting of the board of directors: President, H. P. Kirchner; vice-president, R. A. Jacobs; vice-president and general manager, J. A. Carlin; secretary and treasurer, R. H. Lansburgh; and assistant secretary and treasurer, V. M. Laine.

LUKENWELD, INC. (Division of Lukens Steel Co.), Coatesville, Pa., has appointed the Welding Engineering Co., 2872 N. 41st St., Milwaukee, Wis., representative, handling the sales and service of Lukenweld products in the state of Wisconsin. Marvine Gorham, Jackson Bldg., Buffalo, N. Y., has been appointed representative in the Buffalo territory.

STEDFAST & ROULSTON, INC., 156 Oliver St., Boston, Mass., machinery dealers, announce that, by mutual agreement, they have cancelled their selling contract of Flather lathes in the New England territory, and will hereafter confine themselves to the sale of equipment manufactured by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

LINCOLN ELECTRIC CO., Cleveland, Ohio, has received an order for a complete line of machinery for manufacturing large-diameter steel pipe by the "electronic tornado" automatic welding process, from the Asano Dockyard Co. of Japan. This is the second order in the last six months received by the company for this kind of installation in Japan.

LUKENS STEEL CO., Coatesville, Pa., has established an industrial fellowship at the Mellon Institute of Industrial Research, Pittsburgh, Pa., the purpose of which is to promote the scientific investigation of processes employed in the manufacture of steel plates. Erle G. Hill has been appointed to this fellowship. Mr. Hill is a specialist in iron and steel technology.

BABCOCK & WILCOX CO., 85 Liberty St., New York City, announces a further consolidation of the resources and facilities of the company and the Fuller Lehigh organization, through which the sales offices of the two companies have been combined, and all business will be done in the future in the name of the Babcock & Wilcox Co. through its district sales offices.

R. Fuess, Inc., 245 W. 55th St., New York City, has been established as the American representative of the firm of R. Fuess of Berlin-Steglitz, Germany, manufacturer of instruments for scientific research and industrial control, including microscopes and instruments for general optical observation and material research, spectroscopic apparatus, and testing appliances.

Gears & Forgings, Inc., Cleveland, Ohio, announces that the following concerns have been appointed distributors of the company's speed reducers: Stambaugh-Thompson Co., Youngstown, Ohio; Koontz-Wagner Electric Co., South Bend, Ind.; Ross-Willoughby Co., Columbus, Ohio; Terre Haute Heavy Hardware Co., Inc., Terre Haute, Ind.; and Hardware & Supply Co., Akron, Ohio.

Wickes Bros., Saginaw, Mich., announce that they have concluded exclusive agency agreements covering their entire line of engine lathes, crankshaft turning equipment, and plate working tools in the Philadelphia territory with Lloyd & Arms, 133 S. 36th St., Philadelphia, Pa., and in the New York territory with the Triplex Machine Tool Co., 50 Church St., New York City.

S. F. Keener, 401 Highland Ave., Salem, Ohio, Ohio district representative for Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has placed M. L. Rowe in charge of the Cleveland office at 1940 E. 6th St., which serves the northern half of the state. Another office is maintained at 7 W. 6th St., Cincinnati, to cover the southern half of the state.

Reliance Electric & Engineering Co., Cleveland, Ohio, manufacturer of alternating- and direct-current motors, announces the following branch office changes: The Cincinnati office has been moved to 2905 Carew Tower, with J. L. Van Nort in charge. H. A. Holmes has been placed in charge of the Toledo office. L. M. Dunning has been transferred to the Cleveland district office.

Cleveland Crane & Engineering Co., Cleveland, Ohio, has acquired a substantial interest in the Steelweld Machinery Co. of Cleveland, manufacturer of rolled-steel frame bulldozers, bending brakes, and special machinery. Cyril Bath remains president of the Steelweld Machinery Co., in charge of sales; William F. Wehr, vice-president; A. C. Garnett, secretary; and E. F. Pavlin, treasurer.

Williams, White & Co., Moline, Ill., have acquired the assets and good will of the Rock River Engineering Works, Janesville, Wis., and will continue to manufacture the complete line of bending rolls, hydraulic straightening presses, and hydraulic molding presses made by that concern. G. H. Case, formerly owner and manager of the Rock River Engineering Works, will be associated with Williams, White & Co.

Acme Electric Welder Co., Los Angeles, Calif., manufacturer of Acme Electric "Hot Spot" welders, has removed its eastern offices from 960 Rising Sun Ave., Philadelphia, Pa., to 843 N. Third St., Philadelphia. George M. Hessdoerfer is factory representative and engineer in charge. Complete warehouse stocks of Acme spot-welders and butt-welding attachments are maintained in Philadelphia and other principal centers.

Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis., will have on display during the month of February an extensive exhibit of motor control equipment on the fifth floor of the Engineering Building, 205 W. Wacker Drive, Chicago, Ill. The exhibit will consist of several hundred pieces of equipment, ranging from small photo-electric relays and push-button stations to large high-tension automatic starters. Eugene F. LeNoir will be in charge.

Pratt & Whitney Co., Hartford, Conn., announces that, in taking over the Keller Mechanical Engineering Corporation of Brooklyn, N. Y., as the Keller Division of the Pratt & Whitney Co., the jobbing die business was not included. A new company, the Mechanical Die & Tool Co., a division of the Insulation Mfg. Co., Inc., 11-19 New York Ave., Brooklyn, N. Y., has taken over this part of the work. A general contract tool, die, and mold business will be conducted at the former address of the Keller Mechanical Engineering Corporation, 70 Washington St., Brooklyn, N. Y. A number of the members of the old Keller die department are associated with the new company.

Bryant Machinery & Engineering Co., has been organized, with headquarters at 400 W. Madison St., Chicago, Ill., by A. G. Bryant, who was general manager of the machinery division of Joseph T. Ryerson & Son, Inc., until he resigned to become president of the new organization. Mr. Bryant was with the Ryerson organization for twenty years. For the last two years he has also been secretary and treasurer of the Associated Machine Tool Dealers. The new organization will assume the responsibility for sales engineering, sales management, advertising direction, and general distribution for all territories for a group of manufacturers of machine tools, general metal-working machinery, and special equipment. Among the companies now represented are the Dreses Machine Tool Co., Cincinnati, Ohio; Green Bay Barker Machine & Tool Works, Green Bay, Wis.; Ohio Machine Tool Co., Kenton, Ohio; and Kling Bros. Engineering Works, Chicago, Ill. Special-purpose machinery and welding equipment will also be included. A. P. Schumann, Ira B. Yates, and M. J. Wiora, all of whom were also connected with Joseph T. Ryerson & Son, Inc., are associated with Mr. Bryant in the new enterprise.

Obituaries

Philip Edward Montanus, president and treasurer of the Springfield Machine Tool Co., Springfield, Ohio, died January 15 at his residence in Coral Gables, Fla., at the age of seventy-seven. Mr. Montanus was well known in the machine tool field, having been engaged in the machine tool business for the last thirty-five years.

Mr. Montanus was born in Dresden, Ohio, in 1854. He was first engaged in the retail drug business, but later became interested in the machine tool industry and started the Springfield Machine Tool Co. in 1887. He retired from active participation in the conduct of the business several years ago, turning the management over to his sons, Edward S. and Paul A. Montanus, who are now the active heads of the business.

Mr. Montanus was a charter member and the first secretary of the National Machine Tool Builders' Association, which he assisted in organizing, and was also a charter member of the National Manufacturers' Association, on the board of which he served as vice-president from Ohio. Apart from his manufacturing achievements, Mr. Montanus was prominent in Springfield's civic activities. He was also a vice-president of the Citizens National Bank.

Frank D. Hamlin, vice-president and general manager, and one of the founders of the Earle Gear & Machine Co., Philadelphia, Pa., died suddenly on January 9, from a cerebral hemorrhage, at his home in Philadelphia. Mr. Hamlin was born January 16, 1863, at Waverly, N. Y. His early mechanical training was obtained at the Gleason Works, Rochester, N. Y., where he served an apprenticeship. He is survived by a son, Albert J. Hamlin, who is connected with the Earle Gear & Machine Co.

George Edward Abbott, president of the Abbott Ball Co., Hartford, Conn., died on January 1 at his home in West Hartford at the age of sixty-seven years. Mr. Abbott was born in Gananoque, Ontario, Canada, in 1864, and came to New Britain, Conn., in 1890. Six years later he became connected with the New Departure Mfg. Co., of which he was superintendent until 1908, at which time he organized the Abbott Ball Co.

Memorial to William Gleason Unveiled

Old employes, twenty-year service men, and the present management of the Gleason Works, Rochester, N. Y., gathered December 29 at the company's plant to pay tribute to the memory of the founder and first president of the concern, William Gleason. A magnificent bronze tablet placed in the entrance lobby of the plant, was unveiled on that occasion. George Hunter, the oldest living employe of the company, performed the actual unveiling. He started to work for William Gleason in 1880 and continued with the company for forty-four years, retiring in 1924. Miss Eleanor Gleason, a daughter of the founder, read a brief biographical sketch of her father.

Mr. Gleason was born in Tipperary County, Ireland, in 1836. With his widowed mother, he emigrated to Kingston, Canada, when thirteen years old, and when he was fifteen he moved to Rochester. There he soon went to work for Asa R. Swift, who had a small machine shop on South Avenue, later finishing his apprenticeship at I. Angells & Sons' shop. After having learned his trade, he went to Hartford, Conn., where he worked in Colt's Armory during the Civil War.

In 1865, he returned, to Rochester and started a machine shop in partnership with John Connell and James S. Graham, making machines, tools, and woodworking machinery. The partnership was dissolved in 1873, when Mr. Gleason went with the Kidd Iron Works. While there, he invented his first bevel-gear cutting machine. In 1875, Mr. Gleason purchased the business from Mr. Kidd. He patented the bevel-gear planer in 1876. At first the Gleason business made a general line of machine tools—lathes, planers, etc.—but gradually more and more effort was devoted to the manufacture and improvement of the new bevel-gear planer; and about 1900, the company began to devote itself exclusively to the manufacture of bevel-gear cutting equipment.

In 1889, fire destroyed the three-story structure in which the business was housed, including all drawings and patents, and most of the machinery was wrecked. Mr. Gleason was then over fifty. Within three weeks he had things running again and had finished drawings for an entirely new line of machines.

Mr. Gleason was active until shortly before his death in 1922, although in his latter years he served mainly in an advisory capacity. Those who knew him say that his character is well summed up in the inscription on the tablet, "A master craftsman, endowed with indomitable will, a spirit of independence, and broad vision, who created a new type of machine tool and founded this business on ideals of service and fair dealing."

* * *

Hiram Maxim, of Maxim silencer fame, has designed a sound-proofing and air-filtering device which will be installed in the buildings of Radio City in New York. The device is manufactured by the Campbell Metal Window Corporation, New York City.

Through the operation of principles somewhat similar to those employed in the Maxim silencer for firearms, it prevents noise from entering offices through ventilating spaces. When outside air is brought in under forced draft, all noise is absorbed in a mechanical labyrinth. At the same time, the air is filtered to remove 97 per cent of the soot and dust contained in it.

It is possible to circulate 280 cubic feet of air a minute through this device. With the new device in operation, it is not necessary to open the windows for ventilation. The device is fitted in the radiator enclosures and is not in view; the amount of fresh air required is under easy control. Other adaptations of the Maxim silencer principle have been employed in the quieting of automobile mufflers and exhaust pipes, and for Diesel engines.

How the Railroads Keep Other Industries Going

It is natural that greater interest should be shown in new industries than in older enterprises. There is always a feeling that new industries will open up new avenues for the sale of machinery and supplies. However, the greatest volume of sales of both machinery and supplies is not to be found in the new, comparatively small industries that are springing up, but in the old "standbys"—the automotive industry, the railroad field, and other large groups of industrial activity. For example, in 1930, the last year for which complete statistics are available, the railroads purchased machinery, materials, and supplies, not considering coal or fuel oil, amounting in value to more than $952,000,000.

* * *

Steel Castings to be Discussed at Testing Material Meeting

A symposium on steel castings is to be held at the 1932 annual meeting of the American Society for Testing Materials in Atlantic City next June. The symposium is sponsored jointly by the American Foundrymen's Association and the American Society for Testing Materials. The object is to place on record authoritative data on the engineering properties of steel castings, data that will be of value to designers, producers, and users of castings. Both ordinary and alloy-steel castings will be included. A paper on welding of steel castings will also be presented.

* * *

"Largest Ever Built" Class Increases

In spite of the quiet business conditions, America added, last year, a few items to the "largest-ever-built" class: The largest and highest building in the world was completed—the Empire State Building in New York; the largest American-built ocean liner was placed in operation; the largest airship in the world was constructed; and the most important railroad electrification in the western hemisphere was undertaken.

* * *

Before starting an argument, find out if the person with whom you disagree means the same thing in using a word that you do.—*The Shop Review*

Coming Events

FEBRUARY 1-10—Third International Patent Exposition to be held in the Convention Hall, Philadelphia, Pa. Herman Larson, managing director, Convention Hall, Philadelphia.

MARCH 7-12—Packaging, Packing, and Shipping Exposition to be held at the Palmer House, Chicago, Ill., under the auspices of the American Management Association. Exposition headquarters, Room 602, 225 W. 34th St., New York.

MAY 2-6—Thirty-sixth annual convention and exhibit of the American Foundrymen's Association to be held in the new Municipal Convention Hall, 34th St. and Vintage Ave., Philadelphia, Pa. Executive secretary, 222 W. Adams St., Chicago, Ill.

JUNE 27-30—Semi-annual meeting of the American Society of Mechanical Engineers, jointly with the Canadian Institute of Engineers, at Bigwin Hotel, Lake of Bays, Highlands of Ontario, Canada. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 10-17—Machine Tool Exposition of the National Machine Tool Builders' Association, at Cleveland, Ohio. Boyd Fisher, general manager, 617 Vine St., Cincinnati, Ohio.

New Books and Publications

STATISTICAL ABSTRACT OF THE UNITED STATES (1931). 898 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C. Price, $1.25.

RUNNING A REGAL. Instructions for the operation and maintenance of LeBlond Regal geared engine lathes. 72 pages, 5½ by 8 inches. Published by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Price, 25 cents.

INDEX TO THE AMERICAN SOCIETY FOR TESTING MATERIALS' STANDARDS AND TENTATIVE STANDARDS. 103 pages, 6 by 9 inches. Published by the Society, 1315 Spruce St., Philadelphia, Pa. Distributed free of charge.

FRICTION OF SOME BABBITT ROLLER AND BALL BEARINGS. By Edward R. Maurer and L. E. A. Kelso. 48 pages, 6 by 9 inches. Published by the Engineering Experiment Station of the University of Wisconsin, Madison, Wis.

PROFITS VERSUS COMPETITION. Published by the National Association of Manufacturers, 11 W. 42nd St., New York City. 8 pages, 8½ by 11 inches. Single copies sent free of charge, on application; quantities supplied at 15 cents per copy.

THE POROSITY OF ELECTROPLATED CHROMIUM COATINGS. By W. Blum, W. P. Barrows, and A. Brenner. 15 pages, 6 by 9 inches. Published by the Bureau of Standards, Washington, D. C., as Research Paper No. 368. Price, 10 cents.

THE RELATION OF TORQUE TO TENSION FOR THREAD-LOCKING DEVICES. By H. L. Whittemore, G. W. Nusbaum and E. O. Seaquist. 72 pages, 6 by 9 inches. Published by the Bureau of Standards, Washington, D. C., as Research Paper No. 386. Price, 30 cents.

ANNUAL REPORT OF DIRECTOR OF THE BUREAU OF STANDARDS TO THE SECRETARY OF COMMERCE FOR THE FISCAL YEAR ENDED JUNE 30, 1931. 50 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Miscellaneous Publication 131 of the Bureau of Standards.

SYMPOSIUM ON WELDING. 151 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price (cloth-bound), $1.75.

This pamphlet contains eleven papers presented in a symposium on welding held at the Pittsburgh regional meeting of the American Society for Testing Materials last March. The discussions on the papers are also included. The phases of the subjects covered include the various welding processes, materials and applications, and inspection and testing of welding.

CHARTS AND EXHIBITS IN ANNUAL REPORTS TO STOCKHOLDERS. 56 pages, 6¼ by 9½ inches. Published by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City.

The use of diagrams, charts, and other illustrations in simplifying and clarifying the facts contained in the annual report of corporate enterprises is discussed in this pamphlet. The information is based on an analysis of the reports of thirty-two organizations. The graphic method can well be employed to show such facts as the growth of assets, earnings, sales, production, and orders received over a number of years.

THE INTERNAL COMBUSTION ENGINE. By D. R. Pye. 250 pages, 6¼ by 9¼ inches. Published by the Oxford University Press, 114 Fifth Ave., New York City. Price, $4.

The purpose of this work is to set down the principles underlying engine design and operation, rather than to supply information on the great number of details that a designer must be familiar with. Details of design are mentioned only when they influence or illustrate principles, the book being intended primarily for the student, although it also aims to give the groundwork of a practical knowledge of the subject. The material is divided into seven chapters as follows: Introductory; engine cycles; fuel and their combustion; detonation; combustion in the engine cylinder; thermal efficiency; and the testing of engines.

MECHANICAL WORLD YEAR BOOK (1932). 361 pages, 4 by 6 inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 1/6, net.

Several new sections have been added to the 1932 edition of this well-known little pocketbook, which is now in the forty-fifth year of its publication. The sections on tooth gearing, metals and alloys, and structural engineering have been entirely rewritten and enlarged where necessary, and a new section on electric and gas welding and cutting has been added. The sections on steam boilers, internal combustion engines, belt conveyors, hydraulics, steam engines, turbines, and condensers have been revised and brought up to date. The Classified Buyers Directory in three languages is still an important feature of the book. The index in this edition has been arranged under principal subject headings, with suitable cross-references, which should facilitate finding the required data.

MACHINE DRAFTING. By George C. Snow and J. Charles Russell. 159 pages, 6 by 9 inches; 187 illustrations. Published by the Manual Arts Press, Peoria, Ill. Price, $1.48.

The authors of this book are instructors at the Waltham Evening Vocational School. Mr. Snow was formerly chief draftsman of the Waltham Watch Co., and Mr. Russell was engaged in the construction of precision machinery. Recognizing the need for books of a practical character in industry, they have prepared the present treatise for apprentices and for students in evening and trade schools, as well as for vocational courses in high schools. In preparing the text matter, they have aimed to keep three points in view—the teaching of drawing by the aid of shop problems; the application of machining principles to these problems; and the application of mathematics to shop and drafting work. Briefly, the book covers the use of instruments, principles of mechanical drawing, sketching, geometrical problems, materials of machine construction, and specific problems in tool and machine design.

THOMAS' REGISTER OF AMERICAN MANUFACTURERS. 4642 pages, 9 by 12 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York City. Price, $15.

This is the twenty-second edition of Thomas' well-known directory of American manufacturers. In addition to an unusually complete finding list and index, the directory consists of four sections, the principal one comprising a list of all manufacturers in the United States, classified according to business and product made. Another section gives an alphabetically arranged list of all manufacturers in the country with addresses of home offices, branches, affiliations, and cable addresses. When one concern has succeeded another, this is also noted. Another section lists leading trade names and brands, giving the name of the manufacturer. Still another section lists banks, boards of trade, and other commercial organizations, and leading trade journals.

This book should prove of especial value to sales managers in preparing mailing lists for reaching specific industrial fields; to purchasing agents in locating sources of supply; and to everyone engaged in industrial and commercial work to whom complete lists of manufacturers in specific industrial fields are of value. The work shows every evidence of being compiled with considerable care, and can be highly recommended.

WHAT IS WRONG WITH TAXATION? By Jackson H. Ralston. Published by the Ingram Institute, San Diego, Calif.

Fiscal policies can make or break business and industry. Wise methods of taxation aid and encourage industry; unwise methods hamper and crush it. For that reason, every man engaged in business or manufacturing owes it to himself and his industry to acquire a concise working knowledge of the problems of taxation. The publication *Commerce and Finance* pronounces the present book "probably the most important book on the intricate and disordered subject of taxation that has been written in the past half-century, and written, too, in a way that holds the reader's interest and attention."

The author is an economist as well as a lawyer. He thinks that there is a great deal the matter with methods of taxation. Some of the methods are unscientific, in addition to being unjust and chaotic. The author discusses the principle of taxation; the nature of property; where taxes should fall; the manufacturer and taxation; the merchant and taxation; and

ALL CONTROLS YOU NEED—

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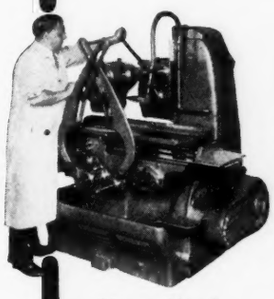

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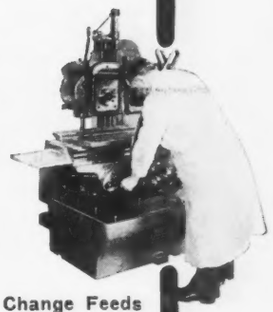
CHANGE speeds—change feeds—adjust table—adjust spindle head—in fact, all the controls required for efficient handling of short and long run production jobs are conveniently grouped, at the front, on the Brown & Sharpe No. 22 Plain Milling Machine.

This convenience not only gives a higher efficiency of operation but also enables quicker setups and changes from one job to another in addition to reducing the non-productive time when changing or sharpening cutters.

For accurate, high production possibilities at low cost, the No. 22 possesses many features unusual in a production milling machine.

A sixteen-page folder giving the advantages of this machine on Short and Long Run Production Jobs will be sent on request.



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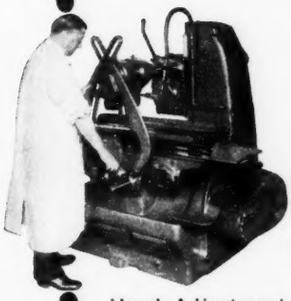

Hand Adjustment of Table and Head

Quick setups when changing cutters and arbors

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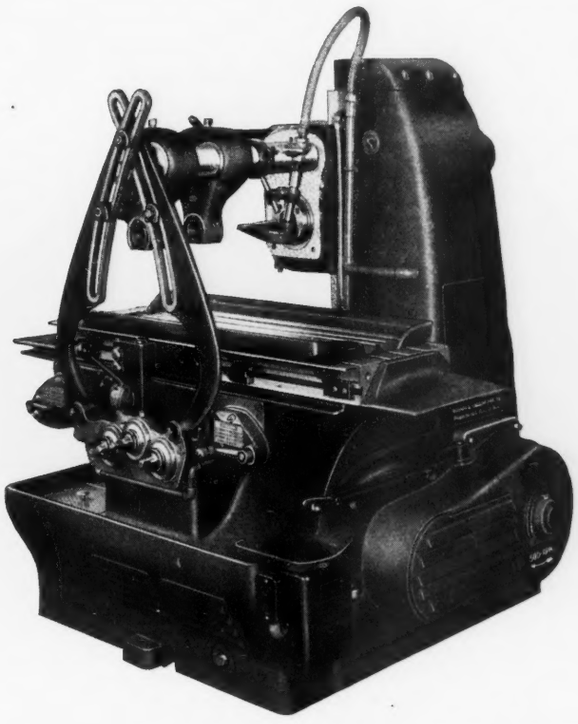
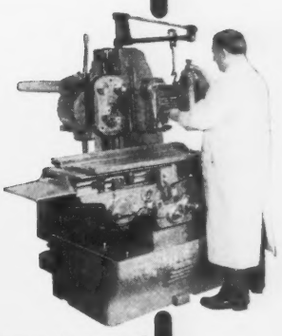
Change Speeds





Convenient handling of vertical milling attachment

the effects of our present methods on business prosperity and on the problem of unemployment.

Among the benefits that he believes would follow the adoption of a scientific method of taxation are more regular employment of labor, greater safety for capital, wider extension of home ownership, and the elimination of serious business depressions.

New Catalogues and Circulars

CLUTCHES. Magnetic Mfg. Co., Milwaukee, Wis. Bulletin 50, illustrating and describing Stearns multiple-disk magnetic clutches.

LOCK-NUTS. Aga Co., Elizabeth, N. J. Bulletin illustrating and describing the type of "elastic stop-nuts" made by this company.

FIRE SIRENS FOR INDUSTRIAL PLANTS. Federal Electric Co., 8700 S. State St., Chicago, Ill. Bulletin 38, entitled "Federal Signaling Equipment."

ELECTRIC SWITCHES. Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis. Bulletin 720EP, describing explosion-proof across-the-line starting switches.

GRINDING MACHINES. Heald Machine Co., Worcester, Mass., is issuing a publication known as *The Heald Herald*, devoted to operations performed on Heald grinding machines.

ELECTRIC MOTORS. Lincoln Electric Co., Cleveland, Ohio. Volume 1, No. 1 of *The Motorizer*, a publication for those interested in alternating-current induction motors.

ELECTRIC WELDING. Lincoln Electric Co., Cleveland, Ohio. Application Sheet No. 26, entitled "Elements of Design," giving instructions for designing bearings for welding.

MOTOR-DRIVEN LATHES. Oliver Machinery Co., Grand Rapids, Mich. Circular illustrating and describing the Oliver No. 51 four-speed motor headstock lathe, with sliding control.

ELECTRIC CONTROLLING APPARATUS. Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis. Circular announcing a new complete line of drum controllers for multi-speed slip-ring, and reversing service.

ELECTRIC MOTORS. Bodine Electric Co., Oakley Blvd. and Ohio St., Chicago, Ill. Bulletin 1007-B, containing data on Bodine constant-speed alternating- and direct-current motors for general purposes.

ALUMINUM PAINT. Aluminum Industries, Inc., Cincinnati, Ohio. Folder describing a new aluminum coating known as Permite Resalum, a paint with unusual ability to resist heat, corrosion, and weather conditions.

CENTRIFUGAL PUMPS. Barrett, Haentjens & Co., Hazleton, Pa. Bulletin 530, announcing a new suction-line primer for centrifugal pumps, which combines in one casting a check-valve, strainer, and air-removing device.

CHEMICAL ANALYSIS. Foster D. Snell, Inc., 130 Clinton St., Brooklyn, N. Y. Booklet entitled "The Consulting Chemist and Your Business," outlining the services that the consulting chemist can render to industrial plants.

DRAW-IN COLLETS FOR LATHES AND MILLERS. Hardinge Bros., Inc., Elmira, N. Y. Circular containing a complete specification and price list for Hardinge draw-in collets, showing the size and style used in standard machine tools.

LUBRICATING OILS. Acheson Oildag Co., Port Huron, Mich. Technical bulletin outlining the application of colloidal-graphited oils in industry. These oils are suitable for use on equipment that must function under high temperatures or heavy pressures.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., Nuttall Works, Pittsburgh, Pa. Leaflet 20536, descriptive of Westinghouse Gearmotors, which consist of speed reducers combined with induction motors into general-purpose unit drives.

DIE-CASTINGS. Allied Die-Casting Corporation, 43rd Ave. and 39th St., Long Island City, N. Y. Folder entitled "Die Casting and the Allied Process," containing comparative data on different classes of engineering materials, including die-casting alloys.

ELECTRIC FURNACES. Ajax Electrothermic Corporation (Division of the Ajax Metal Co.), Trenton, N. J. Bulletin 7, superseding Bulletin 4, descriptive of the spark gap type of high-frequency furnace equipment for laboratory and small-scale production work.

ELECTRIC HARDENING FURNACES. H. O. Swoboda, Inc., 3400 Forbes St., Pittsburgh, Pa., Bulletin 220, supplementing Bulletin 260, containing a diagrammatic outline of Falcon straight-line, continuous electric furnace equipment for hardening and tempering strip steel.

STEEL. Ludlum Steel Co., Watervliet, N. Y., is distributing, in celebration of its seventy-fifth anniversary, a portfolio of photographs taken at the Dunkirk and Watervliet mills of the company by Margaret Bourke-White, which are striking examples of artistic achievement in industrial photography.

CARBURIZING EQUIPMENT. Hevi Duty Electric Co., Milwaukee, Wis. Bulletin 931, describing the development and application of the Carbonol process for carburizing steels. The electric vertical carburizer used for this process is also described in detail, and typical installations are illustrated.

LEATHER BELTING. Chas. A. Schieren Co., 30 Ferry St., New York City. Circular discussing the advantages of manufacturing leather belting from a single tannage. A unique feature of this circular is the arrangement of the illustrations, which are printed separately on cards and slipped into slits in the circular.

MOTORIZED SPEED REDUCERS. Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill. Circular entitled "Slashing Costs," containing data on Janette motorized speed reducers, which are made in single- and double-reduction worm-gear types and single-reduction spur-gear type, with motors ranging from 1/30 to 3/4 horsepower.

GRINDING MACHINES. Churchill Machine Tool Co., Ltd., Broadheath, Manchester, England. Pamphlet UTC-6, illustrating and describing the construction of Churchill motor-driven universal tool and cutter grinding machines. This publication supplements Pamphlet UNV-7, which describes further details of construction.

CASTINGS. Link-Belt Co., 200 S. Belmont Ave., Indianapolis, Ind. Book No. 1250, illustrating and describing Promal castings, which are made from a strong, long-wearing composition originally developed for use in conveying and power-transmitting chain, but now available to any builder of machinery and machine parts in the form of castings.

COOLANT PUMPS. Ruthman Machinery Co., 530 E. Front St., Cincinnati, Ohio. General catalogue, illustrating and describing the various types of coolant pumps made by this concern and the wide number of applications for which they are suited. Complete tables of capacities, dimensions, and other specifications are included for the various models.

ARBOR PRESSES. Greenerd Arbor Press Co., Nashua, N. H. (Henry Prentiss & Co., distributors, 405 Lexington Ave., New York City.) Circular announcing the new No. 50 motor-driven Greenerd arbor press, which is especially designed for rapid continuous work, such as assembling, broaching, stamping, and die work, as well as for general utility service.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular 841B, on magnetic switches. Circular 1442, on air circuit-breakers. Circular 1505, on floodlighting for outdoor construction. Bulletin 86B, on single-phase directional over-current relays. Bulletin 1497, on terminal boards for small wiring. Bulletin 1308, on continuous-rated alternating-current steam-engine-driven generating sets.

LATHES. R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Catalogue entitled "LeBlond Regal Lathes," describing a new type of lathe built by the company to meet the needs of the service shop for all kinds of mechanical and electrical equipment, the garage owner, and the experimenter. The catalogue is completely illustrated, and gives full information about attachments, tool-holders, chucks, and other accessories.

PORTABLE HARDNESS TESTING INSTRUMENTS. R. Y. Ferner Co., 1131 Investment Bldg., Washington, D. C. Catalogue H-1, descriptive of two types of portable hardness testing instruments—one known as the "Duroskop," which is adapted for testing metals and other materials such as rubber, plastic and vulcanized products, etc; and the other known as the Dwarf Brinell press, a portable testing instrument of the Brinell type.

OPTICAL INSTRUMENTS. Bausch & Lomb Optical Co., 619 St. Paul St., Rochester, N. Y. Handbook for metallographers entitled "Optical Instruments for Examining and Analyzing Metals." While this is partly a catalogue of optical instruments manufactured by the company, some of which are listed for the first time, the main part of the book contains essential handbook information relating to metallurgical laboratory work. It gives complete optical information for the metallographer, including a discussion of ultra violet photomicrography and an article on spectrographic analysis. The publication is a real contribution to the science of the investigation of metals.

Calendars Received

GENERAL ELECTRIC CO., Schenectady, N. Y. Calendar with illustrations suggesting the numerous uses of electricity in every field of endeavor.

LINK-BELT CO., Chicago, Ill. Calendar illustrating material-handling, screening, and positive power transmission equipment. A copy of this calendar will be sent by the Link-Belt Co. to anyone requesting it on a business letter-head.